THE HOPE REPORTS

VOL. X

1913—1922

WITH A SEPARATE APPENDIX

EDITED BY

EDWARD B. POULTON, M.A., D.Sc., Oxon, Sydney.

HON. LL.D. PRINCETON, HON. D.SC. DUNELM., F.R.S., ETC.

HOPE PROFESSOR OF ZOOLOGY IN THE UNIVERSITY OF OXFORD

FELLOW OF JESUS COLLEGE, OXFORD

FOREIGN MEMBER K. SVENSKA VETENSK. AKAD., STOCKHOLM

MEMBRE HONORAIRE DE LA SOCIÉTÉ ENTOMOLOGIQUE DE BELGIQUE

SOCIO HONORARIO DE LA REAL SOCIEDAD ESPAÑOLA DE HISTORIA NATURAL

CORRESPONDENT OF THE ACADEMY OF NATURAL SCIENCES, OF PHILADELPHIA

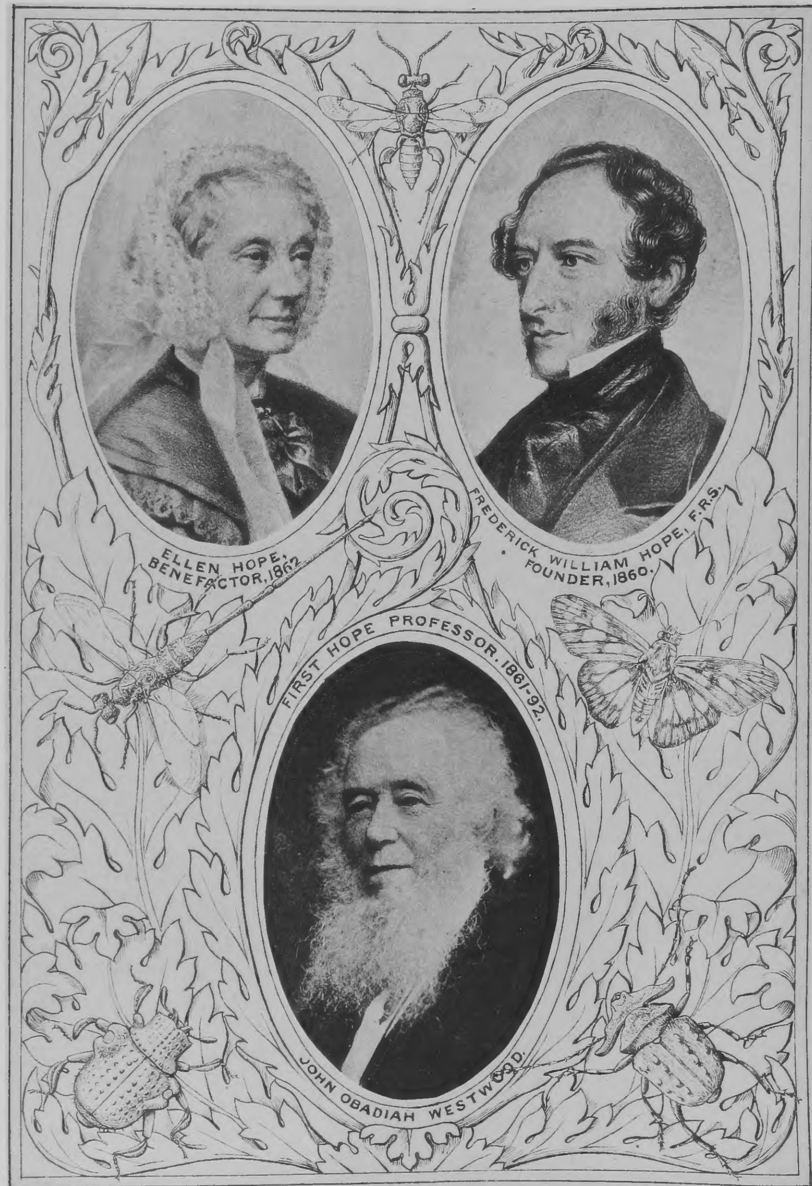
HONORARY MEMBER OF THE ACADEMY OF SCIENCE, NEW YORK

CORRESPONDING MEMBER OF THE SOCIETY OF NATURAL HISTORY, BOSTON, AND THE AMERICAN ENTOMOLOGICAL SOCIETY

OXFORD

PRINTED FOR PRIVATE CIRCULATION

1923



ALFD. ROBINSON, DEL.

THE MAKERS OF THE HOPE DEPARTMENT

OXFORD UNIVERSITY MUSEUM

THE HOPE REPORTS

VOL. X

1913—1922

WITH A SEPARATE APPENDIX

EDITED BY

EDWARD B. POULTON, M.A., D.Sc., Oxon, Sydney.

HON. LL.D. PRINCETON, HON. D.SC. DUNELM., F.R.S., ETC.

HOPE PROFESSOR OF ZOOLOGY IN THE UNIVERSITY OF OXFORD
FELLOW OF JESUS COLLEGE, OXFORD
FOREIGN MEMBER K. SVENSKA VETENSK, AKAD., STOCKHOLM
MEMBRE HONORAIRE DE LA SOCIÉTÉ ENTOMOLOGIQUE DE BELGIQUE
SOCIO HONORARIO DE LA REAL SOCIEDAD ESPAÑOLA DE HISTORIA NATURAL
CORRESPONDENT OF THE ACADEMY OF NATURAL SCIENCES, OF PHILADELPHIA
HONORARY MEMBER OF THE ACADEMY OF SCIENCE, NEW YORK
CORRESPONDING MEMBER OF THE SOCIETY OF NATURAL HISTORY, BOSTON, AND
THE AMERICAN ENTOMOLOGICAL SOCIETY

OXFORD

PRINTED FOR PRIVATE CIRCULATION

1923

PREFACE.

THE preceding three volumes of Hope Reports, VIII, VIII Appendix, and IX, were issued together in July, 1913. A year later, before the accumulation of sufficient separata to make up a new volume, the war came, and with it interruption and a lessened output of work. Researches nevertheless proceeded and were even in some respects favoured by the war. Thus three of the naturalists who have done most for the Hope Department, Capt. G. D. H. Carpenter, Capt. W. A. Lamborn, and the Rev. Canon St. Aubyn Rogers entered ex-German East Africa and have greatly increased our knowledge of the insect fauna, at the same time adding extensively to the University Collections. When, owing to these and other kind helpers of the Department, at home and abroad, one or more volumes might have been issued, increased cost of production and lessened available funds stood in the way, so that when finally the situation was reviewed during the past Christmas Vacation it was found that the separata of nearly 150 papers had accumulated, counting the numerous extracts from the Proceedings of the Entomological Society of London as one for each year from 1913 to 1921. Many of these papers were long, important and extensively illustrated memoirs, and, unless the books were to be inconveniently bulky, as some of the earlier ones undoubtedly are, it was estimated that the whole series could not be compressed into less than five volumes.

Valuable publications are received by the Department in exchange for the Hope Reports, and, the costs having somewhat diminished, it was felt that the arrears must be cleared off and the volumes issued. The delay has been in some respects advantageous, for it rendered possible a convenient grouping of the separata in some

of the volumes, viz., XI, XII and XIII, a grouping fully explained in the prefaces and summarised on title-pages and covers.

Several of the papers or notes in these five books are associated with the names of dear friends who are no longer with us. The debt which the University and the Hope Department owe to them will be spoken of in the prefaces or the papers included in the volumes.

The present volume, X, and its Appendix resemble the majority of the earlier Reports in the varied nature of their contents, so varied indeed that no brief indication of them can be given. The Appendix contains thirty-three memoirs of royal octavo or such other size as would have involved serious injury if the attempt had been made to include them in the regular series. Some account of their varied contents will be found in an introductory note to the volume.

Volume X contains fifty-one papers published in the years 1913—1922. Memoirs 2 to 13 deal with Ethiopian Lepidoptera. No 2, by the late Dr. G. B. Longstaff, D.M., F.R.C.P., a most generous friend to the Department, describes the earlier collections made by Capt. (now Col.) R. S. Wilson in the Southern Kordofan, an interesting and little-known locality. No. 3, by Dr. H. Eltringham, D.Sc., describes Capt. W. A. Lamborn's captures in ex-German East Africa. No. 4, by the late Roland Trimen, Hon. M.A., F.R.S., another friend to whom the Department owes much kind help, Nos. 5 to 9, by Dr. H. Eltringham, and Nos. 10 and 11, by Dr. F. A. Dixey, D.M., F.R.S., contain descriptions of new species and sub-species, and revisions of genera and smaller groups. They deal with the Satyrine (No. 4), Nymphaline (5, 6), Acraeine (7, 8), Lycaenid (9), and Pierine (10, 11) butterflies,—all Ethiopian except No. 11, which

also includes *Pierinae* from other parts of the world. Included in the above series are revisions by Dr. Eltringham of two very difficult groups—*Larinopoda* (9) and the African species of *Neptis* (6).

Nos. 12 and 13 are concerned with Ethiopian moths. The first, by the Professor, on a large collection made by W. Feather, F.E.S., in Somaliland, includes descriptions of 10 new genera, 109 species, and 2 sub-species, by Sir G. F. Hampson, Bart., L. B. Prout, J. H. Durrant and Dr. Karl Jordan. No. 13 contains descriptions of new species by G. T. Bethune-Baker, F.L.S.

Coleoptera form the subject of the next four papers, No. 14 containing notes by M. H. Boileau on the *Lucanidae* (Stag-beetles) of the British Museum and Hope Department, Nos 15 and 16, by G. C. Champion, F.Z.S., on beetles recorded or described by the Rev. F. W. Hope. No. 17, by the same distinguished authority, describes *Anthicidae* from the islands of Mysol and Waigiou, the Oxford material including specimens from the historic collection made by Alfred Russel Wallace.

Three papers deal with Hymenoptera. In No. 18, the collection of Australian ants, made by the Professor in 1914, is described by W. C. Crawley, F.E.S., with notes on habits, etc., by the captor. No. 19, by the Rev. F. D. Morice, M.A., F.E.S., includes the description of a new Chrysid taken by Dr. Longstaff at Khartum in 1909, while Dr. R. C. L. Perkins, D.Sc., F.R.S., in No. 20 discusses the relation of Westwood's genus *Trichogramma* to one described much later by Riley, and concludes that they are the same.

The Neuroptera are represented by a single paper, No. 21, in which Father Longinos Navas, S.J., describes several new species in the Hope Collection.

British insects form the subject of the next five papers,—No. 22 on the butterflies, Nos. 25 and 26 on the Coleoptera of the Oxford District, by Commander J. J. Walker, Hon. M.A., R.N.; Nos. 23A to 23E, a series of notes by F. C. Woodforde, B.A., Exeter College, on the Hope Collection of British Macro-Lepidoptera, which owes so very much to his kind help for many years; No. 24, containing interesting notes on the time of appearance and food-plants of the Trypetid flies of the Oxford District, by A. H. Hamm, F.E.S., of the Hope Department.

The remaining papers, except the last, No. 52, are the direct or indirect result of the fine work done by R. S. Bagnall, F.L.S., F.E.S., during his brief residence in Oxford as Librarian and Assistant Curator of the Hope Department, work which had to be abandoned for other responsibilities arising out of the war.

Papers 27 to 40 all deal with the Thysanoptera (*Thrips*), a group which the author has made his own. Nos. 27 to 35 form a series containing brief descriptions of new species; 33 and 34, published in 1916, being included because they are a continuation of the others. Nos. 36 to 39 contain descriptions of new British species of the same group, No. 40 an account of a Tertiary Thysanopteron from amber. No. 41 deals with a Chalcid parasite of *Thrips*.

No. 42 discusses the systematic position of the Protura, a very primitive group of insects. No. 43, with a coloured plate, refers to British Protura and Thysanoptera, but also includes sections on a British Hymenopteron and British Diptera by F. W. L. Sladen, F.E.S., and J. E. Collin, F.E.S. In No. 44 Bagnall reviews the field work of 1911 in Protura, Thysanoptera and other groups.

In Nos. 45 and 46, two Centipedes *(Lithobius)* new to Britain are described, in 47 the Scottish Symphyla *(Scolopendrella*, etc.).

The series of Bagnall's publications in this volume closes with Nos. 48 to 51, a valuable set of four consecutive papers on the Arthropoda of the area studied by the Vale of Derwent Naturalists' Field Club, and published in its Transactions,—the Woodlice (Terrestrial Isopod Crustacea) in 48, the Myriapods (Centipedes, Millipedes, etc.) in 49, the Spiders, Harvestmen and Pseudo-scorpions in 50, and the *Oribatidae* (Beetle-mites) in 51. W. L. Turner co-operated with Bagnall in writing 50. The Rev. J. E. Hull, M.A., is the author of 51, but, inasmuch as the four papers form a connected series, it is included in the present volume.

No. 52, the Report of the Hope Professor for 1913—1914, gives a detailed account of the work of the Department during the year-and-a-half before the war and in its earliest months. The absence of later Reports up to the present date will be understood by those who read the first two paragraphs, although it must in justice be added that the immense increase in the cost of printing would, under any circumstances, have necessitated a great reduction in length. It is hoped that a Report for 1922 and later years will appear in due course.

EDWARD B. POULTON.

HOPE DEPARTMENT OF ZOOLOGY,
UNIVERSITY MUSEUM, OXFORD.
February 12, 1923.

CONTENTS OF VOL. X.

Full references to the original channels of publication, omitted from some of the separata, are given in the following list. Whenever the vicious habit of re-paging has been followed by the printers, the original number has been added in M.S. to the first page of the separatum.

X. *Butterflies of Southern Kordofan, collected by Captain R. S. Wilson, Lancashire Regiment.* By G. B. LONGSTAFF, M.A., M.D., F.L.S.

[Read May 3rd, 1916.]

WITH MAP.

A VALUABLE addition has been made recently to the Hope Collection at Oxford in the shape of a number of butterflies from the Nuba Hills in Southern Kordofan, presented by Mr. C. A. Willis, late an Inspector in the Civil Service of the Anglo-Egyptian Sûdân, but now Assistant Director of Intelligence at Khartûm.

The butterflies were collected by Captain R. S. Wilson, of the Lancashire Regiment, more than ten years ago, in November and December 1904, but owing to various circumstances they were not examined until recently.

The collection comprises 223 specimens belonging to 62 species of butterflies, and one moth, all from the hilly country lying between El Obeid on the north and Lake Nô on the south, and between Darfur on the west and the White Nile on the east, and is especially interesting since little or nothing has been published concerning the butterfly fauna of that remote part of the world.

To speak more precisely, the area to be dealt with lies between Lat. 12° 40′ N. and Lat. 10° 40′ N.—a distance of about 120 miles, and between Long. 29° 40′ E. and 30° 31′ E.—about 90 miles.

Although none of Captain Wilson's collecting ground is nearer to the White Nile than 90 miles, it all lies within the basin of that river, and it was for that reason that I was asked by some of my Oxford friends to write a memoir setting forth the geographical relationship between the insects in Captain White's collection and those previously dealt with by me in a paper entitled "The Butterflies of the White Nile: A study in Geographical Distribution." *

Naturally, my first desire was to get into communication with the collector, but war conditions made this impos-

* Trans. Ent. Soc. Lond., 1913, pp. 11–56.

sible. However, Mr. Willis has been most kind in giving me all the information at his disposal, and I have pleasure in quoting at some length from his quite admirable letters in reply to my numerous queries.

"The season would be after the rains, when the country is still green and water lying out in places." Among Mr. Willis's kind acts was putting me in possession of the official guide-book, entitled "Kordofan and the Region to the West of the White Nile; Compiled in the Intelligence Department, Sûdân Government, Khartûm," Dec. 1912.

From this book, which is not to be obtained through the usual channels, I learned that: The end of the rainy season, when the crops are ripened but still uncut, is in October or November; in the south the first rain-storms may be expected as early as the beginning of March (p. 14). This confirms Mr. Willis' statement, but seasons, even in the tropics, vary, and in considering statements as to "dry-season" or "wet-season forms," it must not be forgotten that "wet" individuals may, and often do, survive some way into the dry season.

Again, we have this statement: "The places mentioned are probably about 400 ft. higher than the White Nile, but there is very little to go on." Khartûm is said to be 1200 ft. above the sea; Kâkâ is 404 miles higher up the river than Khartûm, and is in about the same latitude as Talodi, the headquarters of the Nuba Mountains Province. Now the guide-book (p. 69) states that Talodi is 2000 ft. above sea-level; from this we may deduce that the White Nile falls 400 ft. between Kâkâ and Khartûm. That is all that I have been able to find out; the two statements seem fairly concordant.

"Kadugli and Dilling are villages situated in the plain in the vicinity of hills, with a 'khor' or rain-fed stream, only running as a rule for a few hours at a time, close by.

"Sungikai is on a biggish khor, lying somewhat north of the hills, running through what we call 'forest' here, which means a rolling country covered with trees about the size of an apple-tree, grass, etc., which dries up in winter, and turns green again as soon as the rainfall about the end of May.

"Tira Mandi and Tatcho are both hills—rough granite blocks with practically no vegetation on them except where the black Nubawi terraces the land, which he does

fairly extensively, and gets a considerable crop of red millet. He also grows a little tobacco. . . . These khors sometimes fill with water and remain full for a long time, and even if they do not, water can generally be obtained by digging in the bed of them.

"The country is alternate 'cotton-soil' (black stuff which cotton does not grow in, but in appearance like the cotton-soil of Eygpt) and a reddish soil which is probably the same black soil mixed with sand, etc."

The official guide-book cited above states that the cotton-soil plains contain too high a percentage of clay to be easily worked and are usually covered with forest, but that the slopes of the Dar Nuba hills, the banks of the khors, etc., are eminently suitable for cultivation, with a rich soil capable of bearing good crops of *dura* and vegetables (p. 25).

Again, to quote Mr. Willis' letter: "The hills stand straight up out of the plain, rising abruptly; sometimes there is a considerable extent of plateau high up where soil can be cultivated, but the appearance of the hills is extraordinarily rocky, though trees grow upon them."

This description of the hills vividly recalls to my mind what I saw at Gebel Ên, and more particularly at Rejâf. The mountains there suggest Nasmyth's description of the mountains of the moon, which he compared to pellets of clay thrown by boys so as to stick upon a wall or fence. The official guide shows that these abrupt hills may be anything from 500 ft. to, in exceptional cases, nearly 2000 ft. above the plain, *i. e.* 4000 ft. above the sea.

Mr. Willis goes on to make the sound suggestion: "It is most probable that the butterflies were captured close to water. It is extraordinary to see them collect on any little damp patch of ground which lies in the shade, and there are always quantities by the watering-places, when the ground is clear of grass and the water has been spilled into troughs or the like for watering animals."

I have myself taken butterflies under like circumstances by the watering-places of baggage mules at Malakand (N.W. frontier of India), but I suspect that the staling of the animals has something to do with it.

"Each side of a khor is heavily wooded and covered with thick vegetation, the depth, of course, varying, and it is in that little belt that all the beasts or butterflies lie at some period of the day."

It should be noted that the specimens bear particulars as to the localities and exact dates of capture; but at present I have no information as to the circumstances under which they were taken, or the plants with which they were associated.

The first thing that struck me on looking at the collection was that it bore internal evidence of being a fair sample of the fauna,* inasmuch as, among others, such a comparatively obscure insect as *Pinacopteryx venata* was represented by a series of nine specimens, as compared with four *Danaida chrysippus*, one *Teracolus protomedia* and one *Terias brigitta*. On the other hand, that the collector had not confined his attentions to the more sluggish insects was proved by the presence of six *Eronia leda*.

The collection had been previously critically examined by my friends, Dr. F. A. Dixey—*Pierinae*, Dr. H. Eltringham—*Nymphalidae*, and Mr. G. T. Bethune-Baker—*Lycaenidae* and *Hesperiidae*, who all very kindly placed their notes at my disposal.

In order to make the comparison of the two papers as easy as possible, I have dealt with the insects in the same order as in the paper referred to. Each species has a serial number, the same in the two papers; where a species occurs in this paper not dealt with in the first, letters are added to the last numeral, 7*a*, 7*b*, etc., the interpolated species being put in what seemed to be suitable places.

The very numerous quotations from these three authorities, as well as those from Mr. Willis's letters are within inverted commas. The old plate of the map in the earlier paper has been used again with a few additions.

Family NYMPHALIDAE.

Sub-family *DANAINAE.*

1. **Danaida chrysippus,** Linn.

α. Curiously enough, the typical form is not represented in the collection.

β. Form *alcippus*, Cram.

One ♂ from Jebel Tira Mandi, Nov. 25, 1904.

"The hind-wing upperside nearly all white, with the

* At least so far as the butterflies to be met with in November and December 1904.

usual exception of the black border inwardly tinged with yellow" (Eltringham).

γ. Form *dorippus*, Klug.

One ♂ and one ♀ from J. Tira Mandi, Nov. 25, 1904.

δ. Form *albinus*, Lanz.

One ♂, Kadugli, Dec. 13, 1904.

"The white covers a large area of the hind-wings. There is the usual trace of the ancestral white bar in the subapical region of the fore-wings" (Eltringham).

2. **Tirumala petiverana,** Dbl. and Hew.

One ♀, Khor Nueila [Lat. 11° 21′ N.], May 26, 1906.

The locality is at least 2° further north than that given in the White Nile list.

Sub-family *SATYRINAE.*

3*a*. **Mycalesis milyas,** Hew.

Two ♀♀ of the dry-season form, Tira Mandi, Nov. 23, 1904.

Not in the White Nile list. Dr. Eltringham notes that the British Museum specimens are from Atbara (Abyssinia). Aurivillius [Seitz, "Gross-Schmetterlinge der Erde"] gives White Nile, and says it spreads to the Congo and Togo.

Sub-family *NYMPHALINAE.*

[4. It is remarkable that *Pyrameis cardui*, Linn., is not included in the collection.]

5. **Precis oenone cebrene,** Trimen.

One ♂, two ♀♀, Kadugli [Lat. 11° 0′ N.], Dec. 13, 1904.

6. **Precis clelia,** Cram.

One ♂, Tira Mandi [Lat. 10° 52′ N.], Nov. 25, 1904.

This is more than 1° further north than in the White Nile list.

"This species has recently suffered from the attention of the German entomologist Strand, who has given nine new names to trifling aberrations" (Eltringham).

7. **Precis orithyia madagascariensis**, Guen.

Three ♂♂ and two ♀♀, Dilling, Nov. 16, 1904; three ♂♂, Tira Mandi, Nov. 23, 25, 26, 1904; one ♂, Kadugli, Dec. 13, 1904.

Of this species Dr. Eltringham says: "The typical *orithyia* was first described from China, the sub-species *madagascariensis* (= *boopis*, Trimen) being the form inhabiting the African continent and Madagascar. The sub-species *here*, Lang, is found in Arabia, and is smaller, and without the red marks in fore-wing cell."

Dilling is nearly $2\frac{1}{2}°$ north of the Bahr al-Zarâfa, the previous White Nile record.

7*a*. **Precis octavia**, f. **sesamus**, Trimen.

One ♀, Jebel Shwai, Nov. 21, 1904; one ♂, Kadugli, Dec. 13, 1904, and one ♀ from the same locality, Jan. 18, 1905.

"The dry-season form of *P. octavia;* one ♀ may be regarded as tending slightly to an intermediate in that it shows rather more red, especially in the fore-wing cell" (Eltringham). Prof. Poulton tells me that this specimen much resembles the Abyssinian form, which is nearer to the western sub-species than to the southern form, which is found in British East Africa.

Although occurring in Abyssinia and Somaliland and widely distributed throughout South Africa, it is not in the White Nile list.

7*b*. **Catacroptera cloanthe cloanthe**, Cram.

One ♂, Khororak, Nov. 29, 1904; one ♂, one ♀, Kadugli, Dec. 13, 1904.

"One ♂ specimen tends towards the dry-season form named *obscurior* by Staudinger, in which the underside is darker" (Eltringham).

This species is not in the White Nile list, but has been found in Abyssinia and is widely distributed in Africa south of the Equator.

9. **Hamanumida daedalus**, Fabr.

One ♂ and one ♀, Dilling [Lat. 12° 3′ N.], Nov. 16, 1904; one ♀, Jebel Shwai [Lat. 10° 11′ N.], Nov. 21, 1904.

"The ♂ tends towards the form *meleagris*, Cram., being somewhat paler underneath" (Eltringham).

At least $2\frac{1}{2}°$ north of previous records.

10. **Neptis agatha,** Cram.

Five ♂♂ at Khororak [Lat. 10° 48′ N.], Nov. 29, 1904.

In my White Nile list, after mentioning that a *neptis* had been seen by me at Kîrô [Lat. 5° 22′ N.], I remark: "This species has been taken at Shoa, in Abyssinia [*circa* Lat. 10° N.]—perhaps the northern limit of the genus in East Africa."

11. **Byblia ilithyia ilithyia,** Drury.

One ♂, "of the wet-season form" (Eltringham), Kadugli, Dec. 23, 1904.

12. **Byblia acheloia acheloia,** Wall. (= *goetzius*, Herbst.).

One ♂, "of the dry-season form" (Eltringham), J. Tatcho [Lat. 10° 48′ N.], Nov. 28, 1904, *i. e.* at least 1° further north than in my White Nile list.

Sub-family *ACRAEINAE.*

14. **Acraea acerata acerata,** Hew.

"One ♂, more or less intermediate to the form *vinidia*, Hew." (Eltringham).

Tira Mandi, Nov. 25, 1904.

15. **Acraea terpsichore,** Linn.

Four ♂♂ and one ♀, all taken at Tira Mandi, Nov. 25, 1904. This is 5° 40′ north of the locality in the White Nile list.

"One ♂ is of the form *rougeti*, Guér., and the ♀ example resembles the ♂♂ more closely than is usual in this species" (Eltringham).

17. **Acraea encedon,** Linn.

"Ten ♂ examples, no two of which are exactly alike. Two nearest the typical form have the ground colour dull and somewhat darkly suffused. One resembles these, but has the fore-wing subapical white dusted with tawny.

The next two are intermediate between this and the *daira* form. The sixth is a nearly typical *daira*, Godm. and Salv., the seventh is of the form *lycia*, Wall., with some tawny suffusion, and the remainder are *lycia* of varying degrees of whiteness" (Eltringham).

All taken at Tira Mandi, Nov. 23, 25, 1904.

This series shows how much the species may vary in the same place and at the same time.

17*a*. **Acraea neobule,** Doubl.

One ♀, "unusually small" (Eltringham).

Taken at Kadugli, Dec. 29, 1904.

Not in the White Nile list. It occurs in Somaliland, Abyssinia and Socotra, and has a wide African distribution.

17*b*. **Acraea caecilia caecilia,** Fabr.

Two ♂♂ and two ♀♀, Kadugli, Dec. 17, 21, 23, 29, 1904.

All the specimens "have the characteristics of the western rather than the eastern form. Abyssinian examples may be of the western form or intermediate to *pudera*, Auriv., the eastern sub-species in which the apical black is narrow and sharply defined" (Eltringham).

A widely distributed species recorded from Nubia (Ambukôl), Abyssinia and Somaliland among other places, but not in the White Nile list.

[17*c*. **Acraea marnois,** Rogen.]

This is regarded by Aurivillius as a variety of *oncaea*, Hopff., but Dr. Eltringham ("African species of Acraea," pp. 184, 185) considers it more nearly allied to *caldarena* and *caecilia*. As the type (at Vienna) came from the Bahr el-Zarâfa it should be added to the White Nile list.]

17*d*. **Acraea doubledayi sykesi,** Sharpe.

A ♂, Kadugli [Lat. 11° 0′ N.], Dec. 17, 1904.

Not in the White Nile list. Dr. Eltringham says of it: "A single ♂ example of this rare species in exceptionally fine condition. This is the most northern record for the sub-species." The sub-species *A. doubledayi arabica*, Eltring., occurs in the Azvaki Ravine, S. Arabia.

Family LYCAENIDAE

I have to thank Mr. Bethune-Baker for determining the butterflies in this family.

19. **Polyommatus baeticus,** Linn.

One ♂, Dilling, Nov. 16, 1904.

20. **Lachnocnema bibulus,** Fabr.

One ♂, two ♀♀, Jebel Shwai, Nov. 21, 1904; two ♀♀, Tira Mandi, Nov. 23, 25, 1904.

The latter place is $2\frac{1}{2}°$ further south than any locality for the species given in the White Nile list.

21. **Tarucus theophrastus,** Fabr.

Two ♂♂, Jebel Shwai, Nov. 21, 1904; one ♀, Dilling, Nov. 14, 1904; one ♀ Tira Mandi, Nov. 25, 1904.

22. **Tarucus telicanus,** Lang.

One ♀, Khor Nubbaka, Nov. 12, 1904.

24*a*. **Castalius lactinatus,** Butl.

. One, Tira Mandi, Nov. 23, 1904; one, Kadugli, Nov. 29, 1904.

Not in the White Nile list. For *C. cretosus*, Butl., of which Aurivillius considers this to be a variety, he gives Senegal and Abyssinia as localities, as well as the White Nile; for *C. lactinatus* he gives Somaliland only.

26. **Catochrysops malathana,** Boisd.

Four ♂♂, and two ♀♀, Tira Mandi, Nov. 23, 25, 1904; two ♂♂, Kadugli, Dec. 13, 17, 1904.

28. **Chilades trochilus,** Frey.

One, Jebal Shwai, Nov. 21, 1904.

30*a*. **Lycaenesthes crawshayi,** Butl., var. *minuta*, B.-B. var. nov.

A ♂, Dilling, Nov. 16, 1904; a ♀, Tira Mandi, Nov. 23, 1904.

Mr. Bethune-Baker has described this as a new variety of Butler's Nyassaland species.* It is but two-thirds of the size of specimens from Sierra Leone and Uganda, though Mr. Bethune-Baker has specimens intermediate in size from the Budonga Forest, in the Congo [4° 30′ S., 20° E.].

31. **Azanus sigillatus,** Butl. [? = *jesous*, Guér.].

One ♂, Tira Mandi [Lat. 10° 52′ N.], Nov. 23, 1904.
This is 5½° further north than in the White Nile list.

31*a*. **Azanus mirza,** Ploetz.

A ♂, Tira Mandi, Nov. 23, 1904.
Not in the White Nile list. The species has a wide distribution in Central and South Africa.

34. **Virachola antalus,** Hopff.

Two ♂♂, three ♀♀, all from Kadugli, Dec. 16, 17, 19, 1904.
This locality is 2½° further south than that given in the White Nile list.

34*a*. **Rapala licinia,** Mab.

One ♂, one ♀, Kadugli, Dec. 17, 23, 1904.
Not in the White Nile list. A South African species extending to Madagascar.

35*a*. **Axiocerces harpax,** Fabr.

Two ♂♂, eight ♀♀, Kadugli, Dec. 14, 16, 17, 29, 1904.
Not in the White Nile list. This is a South African species, recorded by Aurivillius from Waddelai, Lat. 3° N. Kadugli is in Lat. 11° N.

35*b*. **Spindasis kaduglii,** B.-B. sp. nov.

A ♂, Kadugli, Dec. 29, 1904.
Described by Mr. Bethune-Baker, who says that it is near to *S. victoriae*, Butl.†

* See Ann. and Mag. Nat. Hist., 1916, p. 379.
† Ann. and Mag. Nat. Hist., 1916, p. 379.

35*c*. **Argiolaus ismenias**, Klug.

Two, Sungikai, Nov. 13, 1904; two, Kadugli, Dec. 16, 1904.

Not in the White Nile list. A fine but delicate species; the type came from Ambukôl, 6° to the north.

Mr. H. H. Druce has 6 ♂♂ and 1 ♀ from Lagos, of all places; they were captured by Mr. C. A. (later Sir Alfred) Moloney, then governor of the Colony. Mr. Druce writes me that he has since seen others from the same locality (Ann. and Mag. Nat. Hist. 1891, p. 148).

Prof. Poulton says that there are many resemblances between the fauna of Abyssinia and that of the West Coast.

35*d*. **Stugeta marmoreus**, Butl.

Two at Kadugli, Jan. 18, 1905.

Until lately represented solely by Petherick's type from "the White Nile," in the British Museum, but Mr. Bethune-Baker tells me that he has specimens from the Bahr el-Ghazâl to the south. See White Nile list, p. 55 footnote.

Family PAPILIONIDAE.

Sub-family *PIERINAE.*

Dr. Dixey has examined the butterflies of his favourite sub-family with the thoroughness characteristic of him, and has kindly placed his MS. notes at my disposal. All the determinations are his and the copious extracts from his notes are given in inverted commas.

"The Pierinae captured by Captain Wilson number twenty-one species. Of these all but two occur in the records brought together by Dr. G. B. Longstaff in his paper 'On the Butterflies of the White Nile.' The two not there recorded are *Glutophrissa epaphia*, Cram., and *Teracolus celimene*, Lucas. [See notes to these species, 39*a*, 51*a*.] . . . Of the nineteen species common to the two lists, fifteen were previously known to occur in latitudes corresponding to those explored by Capt. Wilson. . . . Eight of the fifteen occur also in Southern Arabia, and several of them have been recorded from the Nile Valley north of Khartûm. The four species included in Dr. Longstaff's list, but not previously known from localities

so far north as Capt. Wilson's, are *Pinacropteryx venata*, *Teracolus achine*, *Eronia leda* and *Terias brigitta*. [See notes to these species under the serial numbers 40, 55, 63 and 67.] . . . It will be gathered that the predominant forms of Pierines in Capt. Wilson's collection are those characteristic of Arabia and North-east Africa. The chief exceptions to the general 'desert' aspect of the Pierine fauna are afforded by *Eronia leda* and *Glutophrissa epaphia*.

"The dry-season characters are strongly marked throughout the series, the chief exceptions occurring in two species of the genus *Teracolus* (*T. eupompe* and *T. evagore*). Of the former species, one specimen is 'wet' and six are 'dry.' Of the latter, two are 'wet' and four 'dry.'"

36. **Herpaenia eriphia,** Godt.

Two ♂♂, Kadugli, Dec. 14, 23, 1904.

"Both of the 'dry' northern form, = *lacteipennis*, Butl."

37. **Belenois gidica,** Godt.

A ♂, Tira Mandi, Nov. 25, 1904; a ♂, Tatcho, Nov. 28, 1904; three ♂♂, Kadugli, Dec. 13, 21, 1904.

"Dry season."

38. **Belenois severina,** Cram.

Four ♂♂, Kadugli, Dec. 27, 1904; one ♀, Sungikai, Nov. 13, 1904.

The latter locality is 1° 20′ north of the furthest range given in the White Nile list.

Dr. Dixey writes: "These are of what is usually considered the wet-season phase. The seasonal colouring resembles that shown by Mr. Marshall's Mashonaland specimens captured in March, and his bred Mashonaland specimens emerging in June after exposure to damp heat as both larvae and pupae. Two of the males are conspicuously marked on the underside with orange-yellow."

39. **Belenois mesentina,** Cram.

A ♂ from Khor Nubbaka, Nov. 12, 1904; two ♂♂, Kadugli, Dec. 23, 27, 1904.

39*a*. **Glutophrissa epaphia,** Cram.

Two ♀♀, Khororak, Nov. 29, 1904.

Not in the White Nile list. Dr. Dixey says: "This species, so far as I am aware, has not hitherto been met with in East Africa further north than Wadelai (about Lat. 2° N.), though Aurivillius gives 'ganz Afrika' as its habitat."

40. **Pinacopteryx venata,** Butl.

Two ♀♀, Sungikai [Lat. 12° 36′ N.], Nov. 13, 1904; one ♂, one ♀, Dilling, Nov. 14, 1904; one ♂, Tira Mandi, Nov. 23, 1904; one ♂, two ♀♀, Tatcho, Nov. 28, 1904; one ♂, Kadugli, Dec. 27, 1904.

Dr. Dixey says: "These differ in some respects from Dr. Longstaff's White Nile series, being generally 'drier.' Two at least of the females are hardly distinguishable (if at all) from dry-season females of *P. simana*, Hopff., and raise doubts as to whether Godart's *doxo*, the locality of which is unknown, may not after all be a female similar to these; in which case *doxo* would have priority as the name of the species."

Dr. Dixey's remarks in "The Butterflies of the White Nile," p. 31, should be compared with this later judgment.

Sungikai is upwards of 3° further north than any locality given for the species in that paper, and its occurrence there was, as Dr. Dixey says, somewhat unexpected.

47. **Teracolus amelia,** Lucas.

A ♂, Tatcho, Nov. 28, 1904; two ♂♂, Tatcho, Dec. 17, 21, 1904.

"Dry: the male taken in November is transitional towards the *catachrysops*, Butl., form of *T. vesta*, Reiche."

48. **Teracolus protomedia,** Klug.

Of this conspicuous species, which I found commonly on the White Nile, a single ♂ was taken at Dilling, Nov. 14, 1904.

49. **Teracolus halimede,** Klug.

Two ♂♂, one ♀, Kadugli, Dec. 14, 23, 1904.

Of these Dr. Dixey says: "Dry; like Dr. Longstaff's and Mr. Loat's from the White Nile."

51. **Teracolus eris**, Klug.

One ♂, Tira Mandi, Nov. 25, 1904; one ♂, two ♀♀, Kadugli, Dec. 14, 17, 21, 1904.

About 2° further south than my specimen captured in 1912. Dr. Dixey says: "Dry. The ♀♀ are 'drier' than any others in the Hope Collection, one of them very remarkably so. This specimen (Dec. 17) is also reduced in size."

51*a*. **Teracolus celimene**, Lucas.

One ♀, Khor Nubbaka [Lat. 12° 36′ N.], Nov. 12, 1904; a ♂, Tira Mandi [Lat. 10° 52′ N.], and another ♂, Kadugli [Lat. 11° 0′ N.], Dec. 14, 1904.

This conspicuous and distinct species is not in my White Nile list; Dr. Dixey says of it: "Has occurred in Abyssinia, and is found as far south as Swaziland and the Transvaal."

53. **Teracolus phlegyas**, Butl.

A ♂, Tatcho, Nov. 28, 1904; a ♂ and a ♀, Khororak, Nov. 29, 1904; three ♂♂, Kadugli, Dec. 17, 21, 1904.

"Dry-season phase. The ♂♂ resemble one caught by Mr. W. S. L. Loat twelve miles north of Kâkâ, White Nile. (See Trans. Ent. Soc. London, 1903, p. 146.)"

54. **Teracolus eupompe**, Klug.

Three ♀♀, Sungikai, Nov. 13, 1904; one ♀, Dilling, Nov. 14, 1904; two ♂♂ and one ♀, Kadugli, Dec. 17, 21, 29, 1904.

"One ♀ is 'wet,' the others and the ♂♂ are 'dry.' All the specimens are small; one ♂ and one ♀ are dwarfs. The wet-season ♀ and the dwarf dry-season ♀ were taken on the same day, Nov. 13. [It may be added that both are alike in poor condition.—G. B. L.] They resemble White Nile specimens captured in February by Dr. Longstaff, but are generally somewhat smaller and 'drier' than Mr. Loat's specimens taken in January and March slightly further south."

55. **Teracolus achine**, Cram.

One ♀, Tira Mandi [Lat. 10° 52′ N.], Nov. 23, 1904.

"Dry-season. Resembles Dr. Longstaff's from the

White Nile, but is ' drier ' than his series from Port Sûdân (Red Sea)." Tira Mandi is 1° 22′ north of any White Nile locality for this species, but 8° south of Suâkin, 8½° south of Port Sûdân.

57. **Teracolus daira,** Klug.

One ♀, Sungikai, Nov. 13, 1904; one ♂, four ♀♀, Kadugli, Dec. 14, 17, 21, 29, 1904.

" 'Dry.' Resemble Dr. Longstaff's and Mr. Loat's from the White Nile; also Dr. Longstaff's from Khartûm."

58. **Teracolus evagore,** Klug.

Two ♂♂, Dilling, Nov. 14, 1904; one ♂, one ♀, Tira Mandi, Nov. 23, 25, 1904; two ♀♀, Kadugli, Dec. 29, 1904.

Dr. Dixey writes: "Two of the ♂♂ (Nov. 14) are wet-season; the remaining ♀ (Nov. 23) and the three ♀♀ are of the dry-season phase (*saxeus*, Swinhoe). The dry-season specimens resemble Dr. Longstaff's and Mr. Loat's White Nile series; the wet-season ♂♂ are like examples from further south and from Somaliland."

61. **Teracolus evarne,** Klug.

One ♂, Khororak, Nov. 29, 1904; one ♂, two ♀♀, Kadugli, Dec. 21, 1904.

" All dry-season. They resemble Dr. Longstaff's specimens from the White Nile (February 1912), but are generally smaller and ' drier ' than the same collector's specimens from the west shore of the Red Sea (March 1912)."

62. **Eronia cleodora,** Hübn.

One ♀, Dilling, Nov. 14, 1904; five ♂♂, one ♀, Kadugli, Dec. 17, 21, 1904.

" These are of the North-east African form, and resemble Dr. Longstaff's and Mr. Loat's specimens."

63. **Eronia leda,** Boisd.

One ♀, Khor Nubbaka, Nov. 12, 1904; three ♂♂, Sungikai, Nov. 13, 1904; one ♂, Dilling, Nov. 14, 1904; one ♂, Tira Mandi, Nov. 23, 1904.

These places range from 2° 40′ to 4° 20′ north of the White

Nile records. Dr. Dixey notes that the ♀ is unusually pale; he also quotes my conjecture that "It would appear that this conspicuous insect does not get further down the White Nile than the Sadd."

65. **Catopsilia florella,** Fabr.

One ♂, one ♀, Sungikai, Nov. 13, 1904; two ♂♂, one ♀, Kadugli, Dec. 14, 16, 1904.

"Somewhat small. Resemble specimens from Khartûm captured in January and February 1912."

67. **Terias brigitta,** Cram.

One ♀, Sungikai, Nov. 13, 1904 [Lat. 12° 21′ N.].

On this species Dr. Dixey's note is: "Dry-season. Dr. Longstaff remarks (in his paper on the Butterflies of the White Nile, p. 48), 'It might appear allowable to conjecture that *brigitta* does not extend far north of Lake Nô, but the fact that specimens of . . . *T. senegalensis* . . . turned up no less than three degrees north of that place makes one cautious.' Capt. Wilson's specimen was caught in the Nuba Hills nearly 3° north of Lake Nô."

Sub-family *PAPILIONINAE.*

70. **Papilio pylades pylades,** Fabr.

Two, Jebel Shwai, Nov. 21, 1904; eight, Tira Mandi, Dec. 23, 25, 26.

"The western form" (Eltringham).

70*a*. **Papilio antheus nyassae,** Butl.

Three, Serraf Fellata [Lat. 11° 54′ N.], May 28, 1906.

"The East African form" (Eltringham).

Not in the White Nile list. The species has a wide Central African distribution.

Family HESPERIIDAE.

Mr. Bethune-Baker kindly determined these for me.

71*a*. **Sarangesa plistonicus,** Ploetz.

One, Dilling, Nov. 15, 1906; four, Tira Mandi, Nov. 23, 25, 26, 1904.

Not in the White Nile list.

71*b*. **Sarangesa pertusa,** Mab.

Three, Kadugli, Dec. 23, 1904.
Not in the White Nile list.

71*c*. **Caprona adelica,** Karsch, var. *Kordofani*, B.-B. var. nov.

One, Tira Mandi, Nov. 25, 1904.

Mr. Bethune-Baker says that this is the dry-country form, whereas *C. cassualalla*, B.-B., is the more variegated western form of the same insect found at Angola.*

I have taken *C. adelica* at Sydenham, Natal. It is not in the White Nile list.

72*a*. **Gegenes obumbrata,** Trimen.

One ♂ of the typical form, Tira Mandi, Nov. 25, 1904.
Not in the White Nile list.

72*b*. **Hesperia mafa,** Trimen.

One, Sungikai, Nov. 13, 1904; two, Kadugli, Dec. 13, 29, 1904.

Not in the White Nile list. This is a South African species.

How does the butterfly fauna of the Nuba Hills compare with the fauna of the White Nile hitherto known to us?

To begin with, material is sadly deficient for such a comparison, as is so often the case. For example, my White Nile list is founded for the most part on captures made in the month of February, whereas Capt. Wilson's insects were taken in November and December. Again, the time devoted to collecting at each place was a matter of days, more often of hours. These limitations should be kept in mind.

Although much of Northern Kordofan is more or less desert in character, both Mr. Willis and the Government Handbook speak of " forests " in the region of the Nuba Hills; it might therefore be reasonably expected that the fauna of the latter would exhibit a forest rather than a desert aspect.

* See Ann. and Mag. Nat. Hist., 1916, p. 380.

The following lists show (A) the twenty species added to the fauna by Capt. Wilson, and (B) the thirty-five species in my White Nile list which he did not happen upon, or at any rate did not send home.*

A. Species taken by Captain Wilson but not in the White Nile list.

3*a*. *Mycalesis milyas*, Hew.
7*a*. *Precis octavia sesamus*, Trim.
7*b*. *Catacroptera cloanthe*, Cram.
17*a*. *Acraea neobule*, Dbl.
[*f. neobule arabica*, Rebel D]
17*b*. *Acraea caecilia*, Fab. D
17*c*. *Acraea doubledayi sykesi*, Sharpe
[*f. doubledayi arabica*, Eltring. D]
30*a*. *Lycaenesthes crawshayi*, Butl.
31*a*. *Azanus mirza*, Ploetz.
34*a*. *Rapala licinia*, Mab.
35*a*. *Axiocerces harpax*, Fab.
35*b*. *Spindaris kaduglii*, B.-B.
35*c*. *Argiolaus ismenias*, Klug. D
39*a*. *Glutophrissa epaphia*, Cram.
51*a*. *Teracolus celimene*, Lucas
70*a*. *Papilio antheus nyassae*, Butl.
71*a*. *Sarangesa plistonicus*, Ploetz.
71*b*. *Sarangesa pertusa*, Mab.
71*c*. *Caprona adelica kordofani*, B.-B.
72*a*. *Gegenes obumbrata*, Trim.
72*b*. *Hesperia mafa*, Trim.

B. Species in the White Nile list but not in Captain Wilson's collection.

3. *Yphthima asterope*, Klug. D
4. *Pyrameis cardui*, Linn. D
8. *Hypolimnas misippus*, Linn. D ?
13. *Atella phalantha*, Drury.
16. *Acraea natalica*, Boisd.
18. *Acraea abdera*, Hew.
23. *Castalius usemia*, Neave.
24. *Cupido cretosus*, Butl.
25. *Catochrysops eleusis*, Dem. D
27. *Zizera lysimon*, Hüb. D
29. *Lycaenesthes amarah*, Guér. D
30. *Lycaenesthes otacilia*, Trim.
32. *Azanus ubaldus*, Cram. D
33. *Deudorix livia*, Klug. D
35. *Hypolycaena philippus*, Fab.
41. *Calopieris eulimene*, Klug. D
42. *Teracolus calais*, Klug. D
43. *Teracolus phisadia*, Klug. D
44. *Teracolus castalis*, Stdgr. D
45. *Teracolus chrysonome*, Klug. D
46. *Teracolus vesta*, Reiche
50. *Teracolus pleione*, Klug. D
52. *Teracolus hetaera*, Gerst.
56. *Teracolus evippe*, Linn.
[*f. epigone*, Feld.] D
59. *Teracolus ephyia*, Klug. D
60 *Teracolus liagore*, Klug. D
64. *Leuceronia buquetii*, Boisd. D
[*f. arabica*, Hopff.]
66. *Terias senegalensis*, Boisd. D
68. *Colias hyale marnoana*, Rogers D ?
69. *Papilio demodocus*, Esp. D ?
71. *Sarangesa eliminata*, Holl.
72. *Gegenes nostradamus*, Fab.
73. *Parnara mathias*, Fab. D ?
74. *Parnara fatuellus*, Hopff.
75. *Rhopalocampta forestan*, Cram.

These lists may be analysed by dividing A and B into sub-families.

	A	B
Satyrines	1	1
Nymphalines	2	3
Acraeines	3	2
Lycaenids	6	9
Pierines	2	14
Papilionines	1	1
Hesperids	5	5

* It is not improbable that Capt. Wilson was so familiar with the typical form of *D. chrysippus* and with *P. cardui*, *H. misippus*, and *A. phalantha* that he did not think it worth while keeping specimens of those species.

Obviously the only really notable difference between them from this point of view is the very small number of new Pierines that Capt. Wilson collected. This may be in part explained—but only in part—by the fact that when on the White Nile I paid special attention to that group and sent home long series.

The extreme scarcity of Satyrines in the White Nile basin is very remarkable. To my *single specimen* of *Yphthima asterope* Capt. Wilson adds *two Mycalesis milyas*. In the nature of things positive observations have much more value than negative, and it is quite probable that a collector working throughout the year might find many more. My own observations in Cape Colony suggest that when Satyrines are scarcest Pierines are most abundant and *vice versâ*.

In the lists, I have marked with a D all the butterflies that I consider to be "desert" insects; this, of course, by no means implies that the species so marked are confined to "desert" areas; far from it. The D indicates that butterflies so marked—however extensive their distribution may be—are such as can live where "desert" conditions prevail.

Deserts differ *inter se*; some are much more barren than others, in some the prevailing surface is sand, in others rock, while some are shingly. Their common characteristic is aridity, an absence of rain for sufficiently long periods to stunt vegetation. Much depends upon season; Col. Yerbury says graphically: "Few . . . have any idea of the effect on 'the barren rocks of Aden' of a few heavy showers; how almost immediately, as if by magic, vegetation springs up in every ravine and water-course, accompanied by a tolerably abundant insect fauna." * Under such circumstances the desert literally rejoices and blossoms as the rose.

The sand-dunes on our British coasts are true deserts, small though they be; on them *C. pamphilus*, *P. cardui*, *A. aglaia*, *C. phlaeas*, *L. icarus* and *astrarche* may generally be found among the bents, while now and then a *Colias* may be seen coursing over the sand; such are desert butterflies, though they may all be found inland living under very different conditions.

Looked at in this way, we see that whereas among

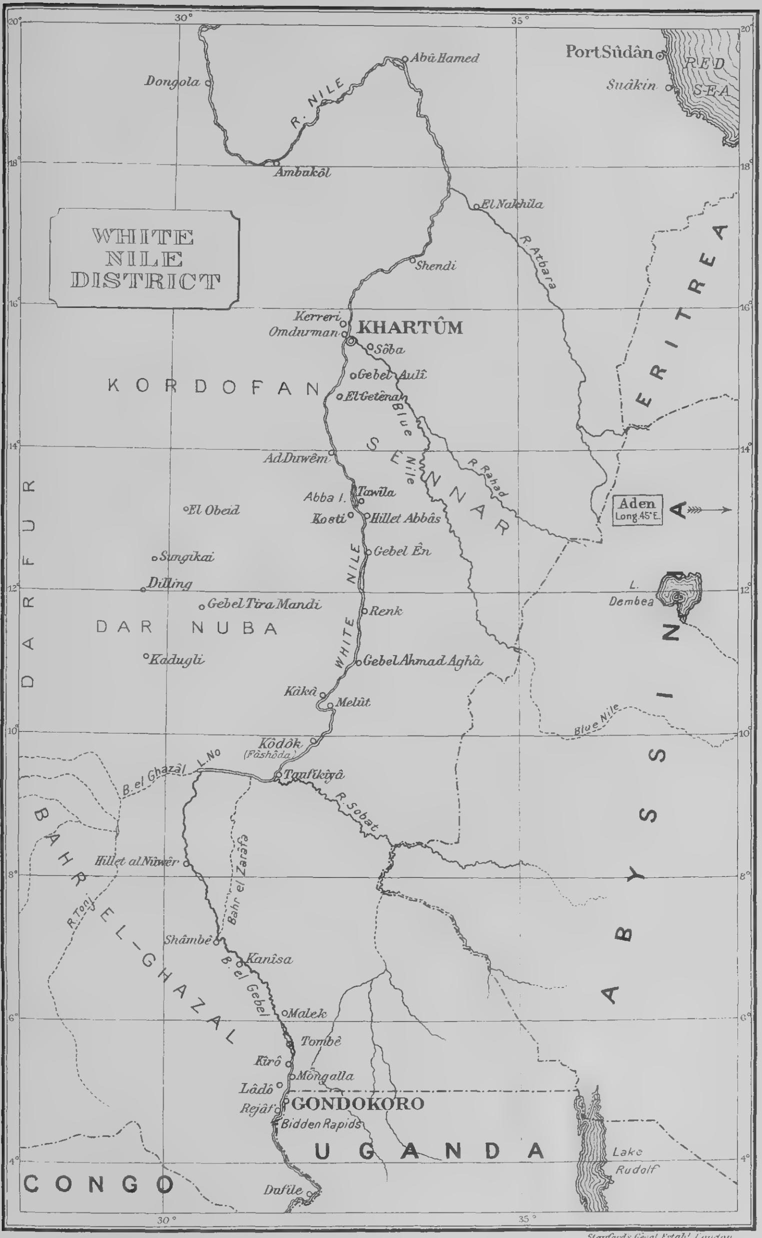
* Journal Bombay Nat. Hist. Soc., 1892, p. 208.

Capt. Wilson's twenty added species *four* only bear the D, no fewer than twenty-two of the White Nile species that he did *not* send home bear that mark.

Undoubtedly the fauna of Southern Kordofan has not the very marked desert character of that found nearer the river, but at the same time it can scarcely be deemed to be a forest fauna.

It is curious that of the ten Skippers not one is common to the two lists.

Capt. Wilson may be congratulated on having taken one species and two varieties new to science.


WHITE NILE DISTRICT
Port Sûdân
RED SEA
Suâkin
Abû Hamed
Dongola
R. NILE
Ambukôl
El Nakhila
R. Atbara
Shendi
ERITREA
Kerreri
Omdurman
KHARTÛM
Sôba
Gebel Aulî
El Getêna
KORDOFAN
Blue Nile
SENNAR
R. Rahad
Ad Duwêm
Abba I.
Tawîla
El Obeid
Kosti
Hillet Abbâs
Aden Long. 45° E.
Gebel Ên
Sungikai
Dilling
L. Dembea
Gebel Tira Mandi
Renk
DAR NUBA
WHITE NILE
DARFUR
Kadugli
Gebel Ahmad Aghâ
ABYSSINIA
Kâkâ
Melût
Blue Nile
Kôdôk (Fâshôda)
B. el Ghazâl
L. No
Taufîkiyâ
R. Sobat
Bahr el Zarâfa
BAHR EL-GHAZAL
Hillet al Nuwêr
R. Tonj
Shâmbê
Kanîsa
B. el Gebel
Malek
Tombê
Kîrô
Mongalla
Lâdô
GONDOKORO
Rejâf
Bidden Rapids
UGANDA
Lake Rudolf
CONGO
Dufile
Stanfords Geog¹ Estab¹, London.

p.322.

XI. *On a Collection of Butterflies taken in East Africa by Mr. W. A. Lamborn.* By H. Eltringham, M.A., D.Sc. *With notes on the* Pierinae, by Dr. F. A. Dixey, F.R.S., *and description of a new form of* P. dardanus ♀, by Prof. E. B. Poulton, F.R.S.

[Read June 6th, 1917.]

The Hope Department at Oxford has recently received a Collection of *Lepidoptera*, chiefly *Rhopalocera*, taken in 1916 by Mr. W. A. Lamborn in the northern central part of what was German East Africa, and it may be not without interest to give particulars of one of the first consignments forwarded from one of our newly acquired territories.

The dates and localities with notes as to the type of country are as follows. The elevations are approximate.

May 3–6	New Moshi	37° 24′ E. 3° 24′ S.	Thin woodland, 2925 ft.
,, 10–11	Sanja River	37° 10′ E. 3° 28′ S.	Plain, 2900 ft.
,, 10–16	Arusha	36° 42′ E. 3° 20′ S.	Dense evergreen forest, 4550 ft.
,, 19–20	Kikuletwa-Darjama R., Noisinak Bridge.	37° E. 3° 30′ S.	Thorn-bush, 3500 ft.
,, 20	Loldiloi	36° 50′ E. 3° 36′ S.	Wooded borders of river, dry plains beyond, 3000 ft.
,, 22	Muruangoin, Ssenje Drift	36° 42′ E. 3° 38′ S.	Thorn-bush, 3550 ft.
,, 26	Lolkissale	36° 26′ E. 3° 50′ S.	Thorn-bush, 4–5000 ft.
June 1–6, 19	Ufiomi (plain)	35° 50′ E. 4° 16′ S.	Dried plain, 4440 ft.
,, 2–6	Ufiomi (woodland)	35° 50° E. 4° 16′ S.	Green river gorge, woodland, with large trees.
,, 9	Ssalanga	35° 50′ E. 4° 30′ S.	Thorn-bush and woodland, 4500 ft.
,, 20	Taranjere River, 2½ m. S. of,	About 36° E. 4° S.	Thorn-bush and woodland, 3300 ft.
July 1	New Moshi	37° 24′ E. 3° 24′ S.	Thin woodland, 2925 ft.
,, 10	Tanga-Moshi Railway, Same.	37° 46′ E. 4° 8′ S.	Thorn-bush, 2900 ft.

July 14	Tanga-Moshi Railway, Mabirioni, ("German Bridge")	37° 56′ E. 4° 36′ S.	Thorn-bush.
„ 23	Handeni	About 38° E. 6° S.	Woodland and thorn-bush, 2800 ft.
Sept. 6	Bagamoyo, 37 m. N. of Dar-es-Salam, on coast		Coco plantation, 100 ft.
„ 13	Ngerengere, on Central Railway, 100 m. W. of Dar-es-Salam.		Thick thorn-bush.
„ 30	Kondutschi, 10 m. N. of Dar-es-Salam, on coast		Coco plantation, 50 ft.
Nov. 10–14	Tanga	5° S. on coast.	Coco plantation, 50 ft.

At the above dates and localities the wet season prevailed until about June 16, when the dry began. The rain of the next change was first encountered on September 6.

DANAINAE.

Danaida formosa, Godm.

A nice series in fine condition.

Same, Mabirioni. 9 ♂♂, 3 ♀♀. May 16–July 14.

D. petiverana, Doubl.

Ufiomi (woodland). 1 ♂. June 4.

D. chrysippus, Linn.

Forty examples, of which only three are typical *chrysippus*. One approaches *alcippoides*, Moore, and three are of the *albinus*, Lanz, form. The rest are all *dorippus*, Klug.* The remarkable corresponding predominance of the *daira* form of *Acraea encedon* in this collection is referred to under that species.

All *dorippus* unless otherwise stated.

Kikuletwa, Darjama River (thorn-bush)—1 ♀ Mar. 19; Loldiloi (wooded river-side)—11 ♂♂, 1 ♂ *chrysippus*, 1 ♂

* In Seitz' "Macrolepidoptera," Professor Aurivillius separates the *dorippus* form as a distinct species, with the remark that there is not sufficient evidence of its specific identity with *chrysippus*! *Any good series, owever, shows many remarkable intermediates, and specimens in the Hope Department bred by the late Col. Manders show in a large number of specimens the instability of the fore-wing apical black. There can be no doubt that* dorippus *is a form of* chrysippus *just as* inaria *is a form of* misippus.

albinus May 20; Lolkissale (thorn-bush)—1 ♀ May 26; Same (thorn-bush) 4 ♂♂, 3 ♀♀, 1 ♀ *chrysippus* July 10; 1 ♂, 1 ♀, 1 ♂ *chrysippus*, 1 ♂ *albinus* July 11; Mabirioni (thorn-bush) 6 ♂♂, 5 ♀♀, 1 ♂ *chrysippus* (approaching *alcippoides*), 1 ♀ *albinus* July 14.

Amauris ochlea, Boisd.

Thirty examples, all typical.
Bagamoyo. 11 ♂♂, 19 ♀♀. Sept. 6.

A. damocles f. damoclides, Stgr.

Loldiloi. 1 ♂. May 20.

A. niavius dominicanus, Trim.

Mabirioni, Bagamoyo. 3 ♂♂. July 14–Sept. 6.

A. albimaculata, Butl.

New Moshi, Sanja R., Ufiomi (plains). 23 ♂♂, 5 ♀♀. May 3–June 6.

[NOTE.—*A. echeria* is rare in Kikuyu, common on Kilimanjaro (Rogers, Trans. Ent. Soc., p. 511, 1908), and *albimaculata* relatively very rare at Entebbe.]

SATYRINAE

Gnophodes parmeno diversa, Butl.

A single example of the southern and eastern race of *G. parmeno*.
Ufiomi (woodland). 1 ♀. June 3.

Neocoenyra duplex, Butl.

A single example, apparently of this species, though differing from typical examples in having the fore-wing eye spot area merely dusted with red brown scales, instead of being distinctly red brown.
Ufiomi (woodland). 1 ♂. June 4.

Physcaeneura leda, Gerst.

Six specimens somewhat variable in size, but otherwise normal.
Tanga. 5 ♂, 1 ♀. Nov. 10–14.

ACRAEINAE.

Acraea quirina, Fab.

Five females of the usual brownish form. The note accompanying these examples describes the locality as dense evergreen forest. This may account for the absence of male specimens, which probably frequent more open situations.

Arusha. 5 ♀♀. May 16.

A. neobule, Doubl.

Five examples of this widely distributed species, all of typical pattern and colour.

Ufiomi (plains), Muruangoin, Same. 5 ♂♂. May 22–July 10.

A. zetes, Linn.

One male of the *acara* form so greatly modified in resemblance to *A. pseudolycia astrigera*, Butl., that the male armature gives the principal evidence of its distinction from that species. *Zetes* and *pseudolycia* are certainly closely allied, and the resemblance would appear to be due to affinity rather than to mimetic association.

Kikuletwa-Darjama River. 1 ♂. May 19.

A. insignis, Dist.

A single female approaching the *siginna* form.

Handeni. 1 ♀. July 23.

A. chilo, Godm.

Of the twelve examples received, ten are of the *crystallina* form of female, the remaining two are males of the ordinary form. It is remarkable that whereas the female *chilo* becomes more transparent as it extends southward, the female *braesia*, and to some extent its male also, becomes more transparent towards the northern limit of its range. The male *chilo*, on the other hand, shows some tendency to heavier spotting as it extends southward. The localities where the present examples were taken are further south than any yet recorded.

Same, Mabirioni. 2 ♂♂, 10 ♀♀. July 10–14.

A. egina, Cram.

Ten specimens, three of which are distinctly of the form *harrisoni*, Sharpe, whilst two other males have slight red streaks in the fore-wing apical area. The *harrisoni* form has previously been reported from Bukoba, L. Kivu district, by Grünberg, who renamed it *kivuensis*, and occasional examples have been noted from Uganda to Nyassa Land. It is merely an intermediate between the type and the form *areca*, Mab.

Ufiomi. 7 ♂♂, 3 ♀♀. June 2–19. (One *harrisoni* ♂, June 2, woodland, the rest plains.)

A. acrita manca, Thur.

A fine series of this interesting form. The characteristic fore-wing subapical spots show considerable variation in number and size, and in one or two examples they are present only on the underside. The fore-wing apical black is slightly broader and the black rings on hind-wing margin are more pronounced than in typical *manca*. The examples are thus to some extent intermediate between *manca* and *manca* f. *lidica*. Nearly all the females have a brownish ground-colour, though in one or two examples there is in the hind-wing a tendency towards the typical flame orange of the male. The wet season continued till about June 16, so that these females are fairly consistently of the wet form.

Ufiomi (plains). 19 ♂♂, 21 ♀♀. June 1–6, 19 (woodland). 1 ♂, 1 ♀. June 5; Ssalanga. 2 ♀. June 9.

A. caldarena f. **neluska,** Oberth.

Two examples of this form occur. They present no unusual features. The form is rather rare in collections.

Handeni. 1 ♂, 1 ♀. June 23.

A. pudorella pudorella, Auriv.

One dwarf male example.

Ufiomi (plains). 1 ♂. June 1.

A. braesia braesia, Godm.

In a long series of this species there is one male example of the *regalis* form, and several somewhat intermediate thereto. No specimen shows the peculiarities of the

Somaliland form mentioned in my monograph, though several of the females are more than usually transparent.

Ufiomi (plains), Same, Tanga Moshi Ry., Ssalanga, Mabirioni, Handeni. 34 ♂♂, 8 ♀♀. June 5–July 23.

A. equatorialis, Neave.

A single male example in fine condition, presenting the coloration of true *equatorialis* combined with the larger size so usually found in *equatorialis anaemia*, Eltr. Also one other specimen of the *anaemia* form, unfortunately without data.

Kikuletwa-Darjama R. 1 ♂. May 19.

A. natalica natalica, Boisd.

Five examples of this common species all of typical appearance.

New Moshi, Sanja R. 4 ♂♂, 1 ♀. May 6–11.

A. anacreon, Trim.

Two examples of this species were taken, one male and one female. Though somewhat faded and worn they are interesting as showing an intermediate condition between *anacreon bomba* f. *induna*, Trim., and *anacreon anacreontica*, Gr. Sm. As in the latter, the fore-wing apical black is very much reduced and the outer half of the wing is ochreous; the base of fore-wing and the whole hind-wing is deep orange as in the *induna* form. They thus support my contention that *anacreon*, *bomba*, and *anacreontica* are all forms of the same species. The resemblance of the female example to the specimens of *acrita manca*, with which it was taken, is very striking.

Ssalanga. 1 ♂. June 9.

Ufiomi (plains). 1 ♀. June 19.

A. encedon, Linn.

Of twenty-one examples there is no specimen of true *encedon*. The *daira* form largely predominates, and *alcippina* is absent. It is interesting to note that of forty examples of *D. chrysippus* in the same collection, three are typical, one is the *alcippus* form, three *albinus*, and all the rest are of the *dorippus* form to which *encedon* f. *daira* corresponds.

Daira.—New Moshi (thin woodland) 5 ♂♂ May 6;

Sanja River (plains) 2 ♀♀ May 10; Arusha (dense forest) 1 ♀ May 10, 2 ♀♀ May 16; Muruangoin (thorn-bush) 1 ♂ May 22; Ufiomi (plains) 1 ♀ June 2; (woodland) 1 ♀ June 5; Mabirioni (thorn-bush) 2 ♂♂ July 14; Handeni (woodland and thorn) 1 ♀ July 23.

Encedon (near *infuscata*)—Arusha 1 ♀ May 16.

Encedon, worn, with rather dull coloration—Ufiomi (woodland) 1 ♀ June 4; Mabirioni 1 ♂ July 14.

Lycia—New Moshi 1 ♀ May 6; Handeni 1 ♂ July 23.

The above analysis of localities shows that there is little or no correspondence between the form and the character of the habitat.

A. sotikensis, Sharpe.

All the specimens are of the form *rowena*, Eltr., distinguished from the typical form by having the inner marginal part of hind-wing patch yellow instead of red. This form has hitherto only been reported from Mt. Ruwenzori.

Ufiomi. 8 ♂♂, 2 ♀♀. June 1–5 (1 ♂, 2 ♀♀ plains, the rest woodland).

A. cabira, Hoppf.

Three examples of the typical form not calling for special comment.

Arusha, Sanja R., Mabirioni. 3 ♀♀. May 10–July 14.

A. acerata, Hew.

Three examples in marking somewhat intermediate between the type and the *vinidia* form. One female is intermediate to the form *tenella*.

Ufiomi (woodland). 1 ♂. June 4.

New Moshi. 2 ♀♀. July 1.

A. terpsichore, Linn.

A long series of this abundant species. All the males are of the form *rougeti*, Guer. The females are not so variable in form as is usual in this species. Four resemble the males, the remainder are largely of the form having dusky fore-wings with more or less whitish subapical patch, one or two having a great deal of white on the fore-wing. Only two of the males have any red marks on the hind-wing underside.

Kikuletwa-Darjama R., Ufiomi, Same, Handeni, New

Moshi. 9 ♂♂, 34 ♀♀. (5 ♂♂, 27 ♀♀. Ufiomi plains, 1 ♀ woodland.) May 19–July 23.

A. pharsalus, Ward.

Two males of the form *pharsaloides*, Holl., which seems generally to replace the typical form in these localities.

New Moshi, Arusha. 2 ♂♂. May 6–16.

A. perenna, Doubl.

One female example of the form *thesprio*, Oberth., in which the red colour extends over the greater part of the fore-wing.

New Moshi. 1 ♀. May 6.

A. oreas, Sharpe.

Two examples of which the male is of the *albimaculata* form, the other, a female, has the tip of the left fore-wing sienna brown instead of black.

Arusha. 1 ♂, 1 ♀. May 13–16.

A. esebrĭă, Hew.

A series showing the usual variability. The majority are of the form *jacksoni*, Sharpe. Two are of the form *protea*, Trim.; one female is form *monteironis*, Butl., and one female intermediate between *monteironis* and *nubilata*, Eltr.

Arusha, Ufiomi (woodland), Same, Mabirioni. 9 ♂♂, 6 ♀♀. May 14–July 14.

A. lycoa, Godt.

Two examples of the form *fallax*, Rogenh. This is the most southern locality I have for this form.

Arusha. 2 ♀♀. May 10–13.

A. johnstoni, Godm.

One male is typical. The other two are of the variety of *confusa*, Rogenh., which has the hind-wing discal patch white as well as the fore-wing spots. (See Trans. Ent. Soc., p. 342, 1912.)

New Moshi, Mabirioni. 3 ♂♂. July 1–14.

Planema aganice montana, Butl.

Kikuletwa-Darjama R., Ufiomi (woodland), Mabirioni, Arusha. 1 ♂, 8 ♀♀. May 16–July 14.

P. quadricolor, Rogenh.

Arusha. 1 ♀. May 13.

Pardopsis punctatissima, Boisd.

Same. 1 ♂, 1 ♀. July 10.

With reference to the position of this species Professor Aurivillius expresses the opinion (in Seitz' "Macrolepidoptera") that pending a knowledge of the early stages it should remain with the Acraeinae, with which it agrees in certain particulars, including the structure of the forelegs. I was at some pains in my monograph of the Genus *Acraea* to point out that the species does not agree with *Acraea* in this last particular.

NYMPHALINAE

Euxanthe wakefieldi, Ward.

Handeni. 1 ♂, 1 ♀. July 23.

Charaxes etheocles, Cr.

New Moshi. 1 ♂. May 6.

C. candiope, Godt.

Ufiomi (woodland). 1 ♂. June 4.

C. cithaeron, Feld.

Kikuletwa-Darjama R. 1 ♂. May 19.

C. zoolina, Westw.

This dimorphic species is represented by two examples, one *zoolina* and the other *neanthes*, Hew.

Kikuletwa-Darjama R. ♀ (*zoolina*). May 20 (wet season).

New Moshi. ♂ (*neanthes*). July 1 (dry season).

C. baumanni, Rogenh.

Ufiomi (woodland). 1 ♂. June 2.

Euryphura achlys, Hoppf.

Ngerengere. 2 ♂♂. Sept. 13.

Euryphene senegalensis orientis, Karsch.

Kondutschi. 4 ♂♂, 2 ♀♀. Sept. 30.

Ephaedra neophron, Hoppf.

Two males of the ordinary form, and one male which appears to be a rather worn and faded specimen of the form *violacea*, Butl.

New Moshi. 1 ♂ (*violacea*). May 6.
Ngerengere. 2 ♂♂ (*neophron*). Sept. 13.

Hamanumida daedalus, Fab.

Handeni. 1 ♂. July 23.

Neptis agatha, Stoll.

Ufiomi (plains). 2 ♀♀. June 1.

N. saclava marpessa, Boisd.

The *marpessa* form is the continental representative of the Madagascar *saclava*, and is very widely distributed.

Ufiomi (woodland). 2 ♀♀. June 5.

Byblia ilithyia, Drur.

Same. 1 ♂, 1 ♀. July 10.

B. acheloia, Wallingr.

Wet f. *vulgaris*, Stgr.
Ufiomi (woodland). 1 ♂. June 2.

Eurytela hiarbas lita, R. & J.

The East African race of *hiarbas*, Drur.
Ufiomi (woodland). 1 ♂. June 2.

E. dryope angulata, Auriv.

The early stages of *hiarbas* and *dryope* are, according to Miss Fountaine, indistinguishable, though their specific identity seems not yet to have been established.

Ufiomi (woodland). 1 ♀. June 4.

Hypolimnas misippus, Linn.

One female of the typical form.
Same. 1 ♀. July 11.

Hypolimnas dubia, Pal.

Four examples of the *wahlbergi* form, showing considerable variation in size, the smallest 70 mm. in expanse and the largest 100 mm. Also four specimens of the *mima* form, of which one, a large female, has the hind-wing pale area white dusted with yellow.

Arusha, Mabirioni. 4 ♂♂ (*wahlbergi*). May 14–July 14.

Ssalanga, Ufiomi (woodland). 2 ♂♂, 2 ♀♀ (*mima*). June 4–9.

Pseudacraea lucretia expansa, Butl.

Handeni. 1 ♀. July 23.

Salamis parhassus aethiops, Pal.

Two fine examples. The species differs from *anacardii*, L., in having a glossy surface on the underside of both wings.

Ufiomi (woodland). 2 ♀♀. June 4.

Pyrameis cardui, Linn.

A female of this ubiquitous species taken at an elevation of 4500 ft.

Ssalanga. 1 ♀. June 9.

Catacroptera cloanthe obscurior, Stg.

One female of the dry form of *cloanthe*, though taken towards the end of the wet season.

Ufiomi (plains). 1 ♀. June 2.

Precis octavia, Cram.

A series of this species of which twelve are of the *sesamus* or dry season form, and one *natalensis*. The first example of *sesamus* was taken on June 2, and the wet season continued till about June 16. The remaining dates extend to June 19. One *sesamus* taken June 19 shows, by the red in the fore-wing cell, an approach towards an intermediate form and to the usual dry form of the west coast.

Ufiomi. 6 ♂♂, 6 ♀♀ (*sesamus*). June 2–6, 19 (3 ♂♂, 6 ♀♀ taken June 19, under eaves of native hut, Ufiomi plains; 3 ♂♂ in woodland, June 2–5).

Ufiomi (woodland). 1 ♀ (*natalensis*). June 4.

P. limnoria taveta, Rogenh.

New Moshi, Same. 1 ♂, 1 ♀. May 6–July 11.

P. antilope antilope, Feisth.

The dry season form.
Handeni. 1 ♂. July 23.

P. terea elgiva, Hew.

Ufiomi (woodland). 1 ♂. June 6.

LYCAENIDAE.

Teriomima freya, S. & K.

Handeni. 4 ♂♂ (one doubtful). July 23.

Spalgis lemolea, Druce.

Tanga. 1 ♂. Nov. 10–14.

Uranothauma falkensteini, Dew.

Ufiomi (woodland). 1 ♂. June 4.

Virachola antalus, Hoppf.

Ufiomi (plains). 1 ♀. June 2.

Polyommatus boeticus, Linn.

Ufiomi (plains). 1 ♂. June 2.

Azanus mirza, Plotz.

New Moshi. 2 ♂♂. May 3.

Azanus sigillatus, Butl.

New Moshi. 1 ♂. May 3.

PIERINAE.

Terias brigitta, Cram.

New Moshi. 1 ♂. May 3.

Terias regularis, Butl.

New Moshi, Tarangere R., Ufiomi (woodland). 9 ♂♂. May 3–June 20.

Teracolus eupompe, Klug.

Tarangere R. 1 ♂. June 20.

Teracolus evagore, Klug.

The form *antigone*, Boisd.
Same. 1 ♂. July 11.

Teracolus halimede, Klug.

Tarangere R. 9 ♂♂, 4 ♀♀. July 10–11.

Teracolus chrysonome, Klug.

Loldiloi, Ufiomi (plains), Tarangere R. 3 ♂♂, 9 ♀♀. May 20–June 20.

NOTE.—From the last-named locality there were eight females and only one male.

Teracolus protomedia, Klug.

Same. 1 ♀. July 10.
"Damaged before capture."

Colias electo, Linn.

Ufiomi (plains). 4 ♂♂, one being white. June 2–3.

Eronia leda, Boisd.

Handeni. 1 ♂. July 23.

Eronia cleodora, Hübn.

Handeni, Mabirioni. 1 ♂, 1 ♀. July 14–23.

Leuceronia argia, Fabr.

Ufiomi (woodland), Handeni. 3 ♂♂. June 3–July 23.

Leuceronia thalassina, Boisd.

Ufiomi (woodland). 1 ♀. June 3.

Leuceronia buquetii, Boisd.

Handeni, Same. 1 ♂, 1 ♀. July 11–23.

Pinacopteryx vidua, Butl.

Ufiomi (woodland). 1 ♀. June 5.

Pinacopteryx pigea, Boisd.

New Moshi, Ufiomi. 4 ♂♂. May 6–June 4.

f. astarte, Butl.

Ufiomi (woodland). 1 ♂. June 4.

Belenois severina, Cram.

Tarangere R., Ufiomi, Same. 1 ♂, 2 ♀♀. June 4–July 11.

Belenois mesentina, Cram.

Handeni. 1 ♂. July 23.

Belenois margaritacea, Sharpe.

Ssalanga. 1 ♂. June 9.

Mylothris agathina, Cram.

Ufiomi, Handeni. 6 ♂♂, 5 ♀♀. June 2, 19, July 23. 1 ♂, 4 ♀♀ Ufiomi (plains); 2 ♂♂, 1 ♀ (woodland).

Nychitona medusa f. **alcesta**, Cram.

Ufiomi (woodland). 4 ♂♂, 4 ♀♀. June 2–6.

PAPILIONINAE.

Papilio nireus lyaeus, Doubl.

Differs from true *nireus* in having a much shorter blue spot in area 2 of hind-wing.

New Moshi. 9 ♂♂. May 3.

P. leonidas leonidas, Fab.

One female example, unfortunately without data.

P. dardanus tibullus, Kirb.

♀ f. nov. **lamborni**, Poult.

The single female was captured June 3, 1916, at Ufiomi (woodland). A male was taken in the same locality on June 6; a second on June 9 at Ssalanga, and a third on July 14 at Mabirioni.

The female is an extremely interesting form, being very similar to that described from much further north in Trans. Ent. Soc., 1906, p. 290—a *trophonius* form from the Kikuyu

Escarpment (6500–9000 ft.) near Nairobi, with the pale markings not white but retaining the primitive yellowish tint of *trimeni*, and the broad orange marking incompletely developed, so that it does not quite fill its usual area, the outer end of the fore-wing patch remaining yellowish. It was pointed out in the paper referred to, that this specimen supported the conclusion that *trophonius* had arisen direct from *trimeni* and not indirectly from it by way of *hippocoon*. The existence of another specimen of the same form from a very different locality affords confirmation. The differences between the two specimens are only such as are found between different individuals of each of the female forms of *dardanus*. Thus, the southern specimen from a lower altitude is considerably larger, being just over 90 mm. in expanse as against just under 80 mm.; but a small size is characteristic of both males and females of *dardanus polytrophus* from the high Kikuyu Escarpment. The southern specimen is darker and richer in colouring, but this difference is intensified by its freshness; its hind-wing orange patch is squarer, with a more pronounced angle in area 5, and is more encroached upon by the broader black margin. A vestige of the "tail" involving the lengthening of vein 4 is seen in the northern specimen but not in the southern, just as it is present in some *trimeni*, but not in others.

In the fore-wing the band of black ground-colour between the sub-apical bar and the orange patch on the inner margin is about twice as wide in the southern specimen, and there is also far less invasion of the cell by this orange patch. Furthermore the sub-apical bar and the spot in the cell are fused in the Kikuyu example, quite distinct in the southern. The cell spot itself is double in the latter, single in the former.

In spite of these and other differences both females belong to a characteristic form for which I propose the name *lamborni*. It may be defined as a *trimeni* form in which the yellowish ground-colour of the main area of both wings is replaced, but incompletely in the fore-wing, by orange. The specimen from Ufiomi is probably more typical, and I therefore select it as the type of this female form.

The three males are all of the *tibullus* form with the black discal band of the hind-wing heavily marked, although not so strongly developed as it commonly is in this sub-species. The band of the specimens taken June 6 and June 9 shows

in area 5 a marked "costal gap," closed on its outer side by a narrow black V with apex outwardly directed. In the male of July 14 a slight indication of the "anal gap" is represented by a thinning of the black band, from without inwardly, in area 3.

The pattern of these three males together with the geographical distribution of all four specimens shows that this *lamborni* female belongs to the subspecies *tibullus*. The Kikuyu example of this form, on the other hand, belongs to *polytrophus*.

E. B. P.

HESPERIIDAE.

Tagiades flesus, Fab.

Ufiomi (woodland). 1 ♂. June 6.

Cyclopides, sp.?

One example not yet identified. This specimen is evidently closely allied to *Cyclopides trisignatus*, Neave, from which it differs principally in the total absence of orange spots in the hind-wing.

Ufiomi (woodland). June 6.

Reprinted from "The Entomologist's Monthly Magazine," 2nd Series, Vol. xxv.

4

DESCRIPTION OF A NEW SPECIES OF *PSEUDONYMPHA* (*SATYRINAE*) FROM SOUTH AFRICA.

BY ROLAND TRIMEN, M.A., F.R.S.

PSEUDONYMPHA DETECTA, *sp. nov.* (Plate XII, ff. 3–6).

Closely allied to, and intermediate between, *P. cassius* (Godt.), and *P. vigilans*, Trim., but nearer to the former.

Exp. al. (♂) 1″3½–6‴ ; (♀) 1″3½–5‴

♂. Greyish-brown; fore-wing with a large disco-cellular and discal deep-fulvous patch; hind-wing with a small discal patch of the same deep-fulvous, not far from hind-margin, between 1st and 3rd median nervules. *Fore-wing*: a well-defined moderate-sized, sub-apical, ovate, black, bluish-bipupillate ocellus in a distinct pale-yellowish, outwardly fuscous-edged ring; fulvous patch occuping discoidal cell from near base, and extending beyond it, superiorly to lower edge of ocellus, and inferiorly below median nervure and its first nervule, but bounded externally by a sub-marginal rather indistinct transverse dark-brown line, commencing on costa beyond ocellus; this patch is in three examples somewhat indistinctly crossed—in one example obscurely *divided*—by a shorter dark brown line just beyond extremity of discoidal cell. *Hind-wing*: small discal fulvous patch bounded externally by a rather faint sub-marginal dark-brown line, and in three examples marked on its outer edge between 2nd and 3rd median nervules with a minute unipupillate ocellus.

UNDER-SIDE. Costa and apical area of fore-wing and entire hind-wing pale brownish-grey, more or less closely hatched and flecked generally with short, irregular, thin, brown striolæ and dots. *Fore-wing*: fulvous patch extending to base itself. *Hind-wing*: two transverse angulated brown streaks, one before the other about middle, usually rather indistinct, and in two examples not traceable; usually two minute unipupillate ocelli—the additional one between 1st and 2nd median nervules; and also a third situated sub-apically between sub-costal nervures.

♀. Like ♂. *Hind-wing*: on under-side, in one of the two examples, the minute ocelli between 2nd and 3rd median nervules are wanting; and in both the median transverse streak is only faintly discernible.

Differs from *P. cassius* on the *upper-side* of fore-wing in the much larger fulvous space, which begins much nearer base and rises higher in discoidal cell; and of hind-wing in possessing a small fulvous discal patch on median nervules, while the conspicuous two sub-marginal ocelli near anal angle in *cassius* are either wanting altogether or only the upper one of them is very minutely represented. On the *under-side* in the *fore-wing* the fulvous space is not so much more developed than in *cassius* as it is on upper-side; while in the hind-wing the three small ocelli are very minute or obsolescent; and the ground-colour of both wings is much greyer and paler, and its striolation and two transverse

angulated streaks are much fainter and without the strong rufous tinge so pronounced in *cassius.*

This form of *Pseudonympha* agrees with *P. vigilans* on the *upper-side* as regards the possession of the small fulvous patch on median nervules of hind-wing, but differs in having a larger fulvous area in fore-wing; it differs further *on both surfaces* in the smaller, less circular, but more conspicuously yellowish-ringed ocellus of the fore-wing, and in wanting or presenting only in very minute form the two (sub-apical and sub-anal-angular) ocelli on the *under-side* of the hind-wing; also this last-named surface is less densely striolated and freckled generally, leaving the two transverse irregular striæ more pronounced.

As long ago as October 21st, 1863, I took two ♂ ♂ of this *Pseudonympha* in Bain's Kloof, the mountain road between Wellington and Worcester, in the south-western district of Cape Colony. I regarded these at the time as a variation of *P. cassius,* but have always kept them in my collection of South African butterflies not among but just apart from my series of *cassius.* Dr. Longstaff's most interesting re-discovery—after so long an interval as fifty years—of this form in both sexes, occurred at Caledon, in the same south-west district of the Cape Province (but perhaps between 30 and 40 miles south-west of Bain's Kloof), five males and two females having been captured by him from January 23rd to February 3rd, 1914.

Mr. N. D. Riley pointed out to Dr. Longstaff that in the British Museum (Natural History) there is a single ♀ *Pseudonympha* identical in characters with the specimens above diagnosed as *P. detecta*, n. sp. This example formed part of the series of *P. cassius* in the Hewitson Collection, received by the Museum about the year 1878, but bears no record of date of capture, or label of locality beyond that of "South Africa."

EXPLANATION OF PLATE XII.

SOUTH AFRICAN *SATYRINAE* OF THE GENUS *PSEUDONYMPHA.*

Fig. 1.—*Pseudonympha cassius,* Godart, ♂; Caledon, Jan. 23rd, 1914.
Fig. 2.—*P. cassius,* ♀; Knysna, Feb. 20th, 1914.
Fig. 3.—*P. detecta,* Trimen, ♂; Caledon, Jan. 29th, 1914.
Fig. 4.—*P. detecta,* ♀; Caledon, Feb. 2nd, 1914.
Fig. 5.—*P. detecta,* under-side; Caledon, Feb. 3rd, 1914.
Fig. 6.—*P. cassius,* under-side; George, Feb. 15th, 1914.
Fig. 7.—*P. vigilans,* Trimen, ♂; Table Mt., March 16th, 1914.
Fig. 8.—*P. vigilans,* Trimen, ♀; Table Mt., March 16th, 1914

Glaslyn, Waterden Road, Guildford:
October 10*th,* 1914.

Plate XII.

Engravers Guild, Ltd.

PSEUDONYMPHA CASSIUS, 1 ♂, 2 ♀, 6 under side.
P. DETECTA, 3 ♂, 4 ♀, 5 under side.
P. VIGILANS, 7 ♂, 8 ♀.

5

[*Reprinted from the 'Entomologist's Monthly Magazine,'* 3rd ser., vol. vii.]

FOUR NEW AFRICAN SPECIES OF *NEPTIS*.

BY H. ELTRINGHAM, M.A., D.Sc.

Being engaged on a systematic investigation of the African species of the Nymphalid genus *Neptis*, I find four hitherto undescribed forms, of which I submit the following account:—

Neptis poultoni, sp. n.

Expanse 38–42 mm. Ground-colour dark sepia with white markings. Fore wing with an inner marginal patch in 1 *a* and 1 *b*, the proximal edge of which forms a straight line continuous with that of the hind-wing discal band. In 2 and 3 are large contiguous spots forming a subovate patch of regular outline. In area 4 a minute white dot placed distally. In 5, 6, and 10 contiguous

spots forming a large subapical patch. Distal to the white markings and roughly following their contour a line somewhat paler than the ground-colour, followed by a band of more or less rounded dark internervular marks, this followed again by three paler lines forming a hind-marginal border. Fringes dotted white between the nervules. Hind wing with a white discal band of regular outline, 4 mm. wide on inner margin and rather broader in 5, thence narrowing to a small spot in 7. Distal to the white band a border similar to that on fore wing.

Underside. Ground-colour paler than above. Costa white at base and as far as cell end. In cell a white line on subcostal curving outwards and downwards, its end pointing to origin of nervule 3. On end of cell a white transverse line, and beyond this, indications of a second indistinct line. Discal white spots as above, but subapical patch extends into 10. The border ornamentation of pale lines much accentuated, owing to increased whiteness of lines, and an additional fine marginal line.

Hind wing brown at base, but with a *conspicuous curved white costal bar from base to end of* 8. Two indistinct narrow whitish streaks on dark ground. Discal band as above, and beyond it a border of same pattern as in fore wing.

2 ♂ ♂, Chigwe, Mabira Forest, nr. Kampala. Taken by Dr. S. A. Neave, 24.vii.1911. Type in British Museum.

Neptis poultoni closely resembles *nemetes nemetes* Hew., and also, but less closely, *trigonophora* Butl. From *nemetes* it is at once distinguished by the curved white distal band in hind-wing underside, and from *trigonophora* by the underside pattern of the hind margins of both wings. The male armature is quite distinct.

Neptis barnsi, sp. n.

Expanse 55–60 mm. Ground-colour sepia-black with white markings. Five white dots in cell of fore wing, and traces of two minute dots beyond. An inner marginal white patch of two elongated spots in 1 *a* and 1 *b*, their proximal edges straight, outer ends slightly separated. In 2 and 3 two white marks, proximally just separated by nervule 3, but distally more widely divergent. In area 4 an obsolescent white streak (in some co-types well developed). In 5 and 6 elongated spots divided by nervule 6 and distally divergent. A small spot in 9 near costa. Distal to white markings and roughly following their contour a fine line of bluish-grey scales which is thrown into a series of arches between the nervules. Following this, three bluish-grey lines continuous except at the nervules. Fringes spotted white between the nervules.

Hind wing with a discal white band about 5 mm. wide, rather narrower at inner margin, slightly projecting proximally at median, and extending to area 6. Distal edge of band indented on nervules by the ground-colour and slightly powdered with black between. Three bluish-grey submarginal lines as on fore wing, and midway between the innermost of these and the discal band a narrow line somewhat paler than the ground-colour.

Underside. Ground-colour paler than above. Fore-wing costa white at base and nearly to cell end. In cell a series of rather complicated white

markings, consisting of a basal streak terminating in a spot, a transverse streak, two small spots, and two at each cell end. Beyond this, three or four very small spots. Large white marks as on upper side, that in 4 more fully developed, the pale lines all much more accentuated but white, not bluish-grey, and there is a trace of an additional fine line at and below the apex.

Hind wing with a large curved white costal band from base nearly to end of 8, followed by two less definite white bands on the brown ground-colour. Discal band as on upper side, and rest as on fore wing.

8 ♂ ♂. Type, Belgian Congo, between Ituri and Epulu Rivers (*Barns*), March 1920 (*Coll. Joicey*).

Co-types, Bitje, Ja River (1), Upper Kassai (5), Semliki Valley (1).

This species closely resembles *seeldrayersi* Auriv., from which it may generally be distinguished by the obsolescent character of the streak in fore-wing area 4, and by the fact that the pale line on fore wing immediately distal to the discal markings is deeply arched (distally convex) between the nervules. The male armature is quite distinct from that of any other described species.

Neptis rothschildi, sp. n.

Expanse 50–55 mm. Sepia-black with white markings. Fore wing with a white cell streak, beginning at base and passing between nervures 4 and 5 to a point considerably beyond the origin of 3. Elongated inner marginal spots in 1 *a* and 1 *b*, distinctly separated. Two similar discal spots in 2 and 3 still more separated. A white dot distally placed in area 4, and a series of three well-separated elongated spots or streaks in 5, 6, and 9. Distal to these discal spots and following their contour a very fine line of greyish-white scales. Beyond this a well-developed white line, broken into spots by the nervules. Finally two delicate submarginal lines.

Hind wing with a discal band about 3–4 mm. wide from inner margin to nervule 6, the spots of which are distinctly separated by the nervules. Distal to this a very faint line, rather paler than the ground-colour, followed by a narrow white secondary band of quadrate spots separated by the nervules. Two delicate submarginal lines.

Underside. Pattern of upper side repeated, but the white marks more pronounced on a paler ground. Fore wing white on costa at base. Cell streak larger and more sharply outlined. Above end of cell two or three additional white streaks. White submarginal bands much more distinct, especially inner one, which is widened to about 1·5 mm., and there is an extra distal line at apex.

Hind wing with a white costal band from base to middle of costa. The secondary discal band composed of spots much larger than above.

2 ♂ ♂. Type, Kingour Forest, Manyema, Congo Free State (no date) (*Mus. Tring*).

Co-type, Upper Kassai (no date) (*Coll. Joicey*).

This species most nearly resembles *paula* Staud, but is quite differently marked in fore-wing cell above and below. Ward's *biafra* is also similar, but has three transverse white stripes in cell. All three differ from other described species in having a secondary white discal band on the hind wing. The male clasper of the present species is quite different from that of *paula*. I have not had an opportunity of examining that of *biafra*.

Neptis rogersi, sp. n.

Expanse about 50 mm. Sepia-black with white markings. Fore wing cell with three or four white dots and three beyond it. An inner marginal white patch of two spots in 1 *a* and 1 *b*. Two large subquadrate spots in 2 and 3 separated proximally by the nervule, and distally by a slight invasion of the ground-colour. In 4 a small subtriangular spot, distally placed. Three subapical spots in 5, 6, and 9, the first two subquadrate, distally divergent, and the third a small streak. Just distal to the white discal marks a white line roughly following their contour. This line is not arched between the nervules. Following this, two fine submarginal lines with faint indications of a third, the first breaking into three small but rather conspicuous spots near the costa.

Hind wing with a white discal band 7–8 mm. wide, straight, and sharply defined proximally, regular but invaded by the black nervules distally. The outer edge of the band is closely followed by a pale line, and there are three more pale lines forming a marginal border. Fringes white between nervules.

Underside. Not markedly paler than above. All the lighter markings chalky white. Fore-wing with white at base of costa and a complicated pattern of lines and spots in cell. In the type form there is in the cell a line along the subcostal having two downward projections, between which is a small spot. Just beyond end of this line another spot, and on the median side three spots, one longitudinal and two transverse. Four or five small spots beyond cell. (In the co-type two of the spots coalesce to form a transverse line across cell end.) The spot in 4 is very little larger beneath than above, but more sharply defined and definitely triangular. The discal and submarginal lines are broader and more distinct, only separated by fine dark lines.

Hind wing with a curved white costal band, but this much narrower than in *barnsi* and *seeldrayersi*. This followed by two very distinct curved white bands. White discal band very broad and extending from inner margin to area 7. Other lines as on fore wing.

2 ♀ ♀. Rabai, 26.vi.1999 and 15.vii.1911 (*Rev. K. St. A. Rogers*). Type, Oxford.

I hesitate to describe a species from ♀ ♀ only, but the two examples from which the above account is compiled do not correspond with any other forms in the collections which I have examined. They are at once

distinguished from *agatha* and *seeldrayersi* by the small spot in fore-wing area 4, whilst they differ from *barnsi* in the straight formation of the fore-wing discal line bordering on the large white spots. Also in the much narrower hind-wing basal costal band and in the pure white markings of the underside.

I hope shortly to be able to publish figures of the above forms together with a revision of all the known African species.

Hope Dept., University Museum, Oxford :
December 1920.

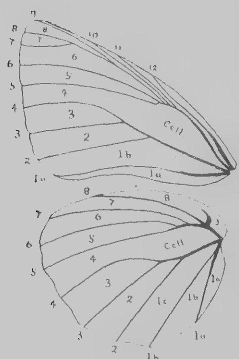
6

XIII. *On the African Species of the Genus* Neptis *Fab.* By H. Eltringham, M.A., D.Sc., F.Z.S.

Plates XX—XXV.

[Read Oct. 5th, 1921.]

The Genus *Neptis* was founded by Fabricius in 1807. It includes many species of small or medium-sized butterflies usually characterised by white or yellow markings on a sepia black ground-colour. Two species occur in Europe. The genus extends over the whole of the African and Oriental regions and into Australia. The wing neuration is as shown in the accompanying diagram. Its arrangement is fairly constant, though there is a certain instability in the point of origin of the tenth nervule in the fore-wing, which may arise at or beyond the end of the discoidal cell. The fore-feet are of the usual Nymphalid character, and serve as an easy method of distinguishing the sexes. The hind-feet have two simple claws, a well-developed pulvillus, and very rudimentary paronychia.



The characteristic patterns and markings of *Neptis* are such that the species are unlikely to be confused with those of any other genus except *Athyma*. If the example be a male, it may be distinguished as *Neptis* from the fact that the hind-wing costal nervure (8) ends on the costa in *Neptis*, whilst in both male and female *Athyma* this nervure ends on the hind margin. If it be a female, *Neptis* may be distinguished by the precostal nervure, which is straight where it arises from the costal, whilst in *Athyma* it follows a continuous curve from its origin; also in *Neptis* the subcostal nervures in the hind-wing arise much nearer to the costal than in *Athyma*. Further, in *Athyma* there is near the origin of the fore-wing median nervure a short spur on the inner marginal side. Such a spur is absent in *Neptis*.

The larvae are but little known. That of *dumetorum* will be described under that species.

The present paper is an attempt to deal with the forms and species of the Ethiopian region, though it cannot claim to be a complete revision, owing to lack of sufficiently long series of many forms. It may be that collectors generally, deceived by the great monotony of pattern and colouring, have neglected the genus in the belief that comparatively small series of specimens were sufficiently representative. It may be that some of the forms are really comparatively rare. In either case the fact remains that many species are but poorly represented in collections, whilst the difficulty of identification has led to numerous errors of nomenclature. So far no serious effort seems to have been made to investigate the relationships of the various described species, though at the same time, considering the fine distinctions and in some cases almost indescribable differences between what are really separate species, the literature of the genus is not wanting in certain shrewd diagnoses of their affinities.

As a problem in taxonomy the genus presents a number of difficulties, some of which in the absence of adequate material still remain unsolved. There are genera of Lepidoptera in which the male armature furnishes good and constant characters, enabling us to confirm or amend conclusions founded on outward and more easily observed features. In other cases we know that these anatomical structures are of so simple a nature that they are of little value in specific diagnosis.

In the African forms of *Neptis* we have in some instances instability of pattern combined with variability of anatomical structure, each condition tending to throw doubt on conclusions based on the other. Some species can be isolated with ease on well-differentiated characters of the male armature. In other cases we have forms very different in outward appearance, but not constantly distinguishable in the anatomical characters. If, for example, we take two forms A and B, of different pattern, and dissect and examine the genitalia, one mounted specimen of each may show recognisable differences. If, however, we take another example of A the armature may present differences from the first specimen of A, such differences being as great as those between B and the original A. Again, we may make preparations from two examples C and D, whose external

differences are of the slightest and by no means so great as the outward variations of undoubted forms of the same species, only to find that the respective armatures are so completely distinct that specific identity is out of the question.

Furthermore, there are forms, the external facies of which are so utterly different that we are bound to regard them as well-separated species, but the male armatures are not merely doubtfully distinguishable but of a highly complex form.

The form of the male armature also raises another question. Given several distinct types of structure in these organs, each type being broadly distinguishable from the others, how far are we justified in assuming that the members of the genus referable to one particular type of armature are necessarily more nearly related to each other than to species whose armatures fall under another type—that, in fact, they form an intra-generic group? If we do this with *Neptis* it is true that the majority of forms in groups so constituted seem fairly naturally associated, but at the same time there are instances in which two or more forms of totally different outward facies have armatures which are not constantly distinguishable. Thus *trigonophora* and *kikideli* are apparently widely separated, and yet it would be impossible to decide from a number of preparations which belonged to the former and which to the latter. This is not a question of a very simple structure of the armatures, since the claspers of these two species are of a curious form considerably elaborated and totally unlike those of any other African species.

A far more complicated case is that of the forms which include *ochracea*, *exaleuca*, *woodwardi*, *swynnertoni*, *incongrua*, and other species. At first sight the only difference between *exaleuca* and *ochracea* is that of colour. Grünberg on one occasion referred to an example of *ochracea* as *exaleuca* var. *ochracea*, a terminology I should have been inclined to support in the absence of anatomical preparations. Nevertheless, we find that whilst the claspers in *ochracea* are of fairly constant form, and that a peculiarly specialised one, those of *exaleuca* are extremely variable, though none of the variations resembles the clasper of *ochracea*. Close as is the resemblance between these two species in everything except colour, the clasper of *ochracea*, whilst apparently constantly distinguishable from that of

exaleuca, is not easily distinguishable from that of *incongrua*, *woodwardi*, *neavei*, and, most remarkable of all, *nemetes*. All these species are totally different in outward appearance from *ochracea* and from each other.

Again, the form described by Lord Rothschild as *neavei* is outwardly almost indistinguishable from the previously described *swynnertoni*, yet the armature of *swynnertoni* approaches that of *exaleuca*, to which species it has no outward resemblance whatever, whilst the claspers of *neavei* resemble those of *ochracea*, with which again there is no outward agreement. Where the structure of the armature is of a particularly simple kind and not subject to any characteristic elaborations no difficulty arises. Where, however, that structure is found to be highly modified, and also of a very distinct character as compared with other forms in the same genus, we should at first sight be tempted to suppose that those species possessing a distinctive type of armature were therefore closely related. But, as we now see, in the genus *Neptis* there are species whose armatures are most closely similar and highly specialised, which, to judge by their outward facies, are very widely separated. At the same time there are forms which appear nearly allied in their outward characters, but have markedly different genitalia.

Apart from the foregoing examples we have the difficulty of the forms of *nysiades* described more fully under the heading of that species.

Dr. W. J. Holland (Bull. Am. Mus. Nat. Hist., xliii, 6, p. 164, 1920) proposes a new genus, *Neptidomima*, in which he places one species *Neptis exaleuca*. He bases this separation on the structure of the palpi, which he describes as " more robust, porrect, and hirsute " than in any species known to him. It is true that the palpi in this species are densely clothed with flat scales, most of them black. The same, however, applies to the palpi in *woodwardi*, *ochracea*, *incongrua*, and some other species. If we are to take this character as generic, then the other species named must also be included in the new genus. Now, the genital armatures of these forms are of the same character as that of *nemetes*, certainly a true *Neptis*. For reasons stated above I cannot, in this genus at least, attach too much importance to the armature as a test of near affinity; nevertheless, the establishment of a separate genus for *exaleuca* and the other species with similar palpi

seems to me unnatural and based on very insufficient characters. As Heron pointed out years ago (see Trans. Ent. Soc., 1911, p. 7), the palpi of *Acraea johnstoni butleri* differ from those of other species of *Acraea*, including all the other forms of *johnstoni* itself. As *butleri* is merely a local form of *johnstoni*, we have here an example in which the difference in the palpi is not even a specific character. It is perhaps not irrelevant to add that the name *Neptidomima* is in any case undesirable, since it suggests a genus whose members mimic *Neptis*. Thus the generic names *Crenidomimas*, *Mimacraea*, *Pseudacraea*, etc., all have a significance which is well understood and supported by considerable evidence, whereas *Neptis exaleuca* and its allies, so far from being mimetic of other species of *Neptis*, are of all the genus the most aberrant in their facies.

In the descriptions it will be noted that several species have a pearly iridescent area on the underside of the h.-w. in the male. Special scales can be observed in this area, and my friend Dr. F. A. Dixey has kindly examined them for me. It would not, however, appear that they are of specific importance.

I have pleasure in acknowledging the kind assistance I have received from Dr. F. A. Dixey, F.R.S., Mr. J. J. Joicey, Dr. K. Jordan, M. Ch. Oberthür, Prof. E. B. Poulton, F.R.S., Mr. N. D. Riley, Lord Rothschild, F.R.S., and Mr. G. Talbot. I should like also to express my appreciation of Mr. Alfred Robinson's admirable photographs, from which the plates of imagines have been printed.

KEY TO THE AFRICAN FORMS OF THE GENUS *NEPTIS*.

(The sexes are alike in pattern.)

Some or all of the discal spots and bands of upperside yellow.	*a.*	
All paler markings above, white (rarely bluish).	*g.*	
(*a*) F.-w. cell on underside contains white dots, usually also visible above.	*b.*	
Cell without white dots.	*d.*	
(*b*) F.-w. inner marginal spot absent or only faintly developed . . .	*comorarum.*	(545)

	F.-w. with a well-marked inner-marginal spot, sometimes confluent with spots in 2 and 3.	*c.*	
(*c*)	Expanse about 50 mm., h.-w. discal band only about 3 mm. wide, distally edentate	*dumetorum.*	(543)
	Expanse about 35 mm., h.-w. discal band about 5 mm. wide, distally regular .	*mayottensis.*	(545)
(*d*)	Discal yellow band broad (4–5 mm.) quite or nearly continuous from inner margin of h.-w. to f.-w. area 3, its proximal margin almost a straight line.	*e.*	
	Yellow band narrower (2–3 mm.) and having a curved proximal outline from inner margin of h.-w. to f.-w. area 3.	*f.*	
(*e*)	F.-w. band continuous from inner margin to area 3	*ochracea.*	(554)
	F.-w. band interrupted by ground-colour in anterior half of 1*b* . .	*ochracea ochreata.*	(554)
(*f*)	H.-w. band nearer to base than to hind-margin, short and pale ochreous .	*woodwardi.*	(553)
	H.-w. band nearer to hind-margin than to base, long and deep yellow . .	*frobenia.*	(542)
(*g*)	Base of h.-w. beneath practically unicolorous with rest of ground-colour (generally red-brown) not striped or spotted.	*h.*	
	Base of h.-w. beneath striped or spotted.	*m.*	
(*h*)	White spots within f.-w. cell.	*i.*	
	No white spots in cell.	*j.*	
(*i*)	On h.-w. underside a small white spot in area 6	*neavei.*	(556)
	No white spot in area 6	*swynnertoni.**	(556)
(*j*)	Underside ground-colour red-brown or orange-brown.	*k.*	
	Underside ground-colour ochreous .	*exaleuca exaleuca.*	(555)
(*k*)	H.-w. underside without heavily marked dark internervular rays . . .	*incongrua incongrua.*	(552)
	H.-w. underside with heavily marked dark internervular rays.	*l.*	

* This is the principal difference between typical *neavei* and *swynnertoni*, and it is not a constant one. Nevertheless, the male armatures differ. (See under descriptions.)

(*l*) F.-w. with three or four minute white dots beyond cell, h.-w. white band about 2 mm. wide . . . . *incongrua occidentalis.* (553)
F.-w. without such minute dots, h.-w. band about 5 mm. wide . . . *exaleuca suffusa.* (556)
(*m*) Base of h.-w. beneath irregularly marked and spotted not with regular pale bands on a dark ground. *n.*
Base of h.-w. beneath with curved bands of white or whitish on a dark ground *r.*
(*n*) F.-w. cell nearly all white. *o.*
F.-w. cell dark or only with white dots . *p.*
(*o*) H.-w. discal band only about 3 mm. wide . . . . *metella.* (548)
H.-w. discal band about 5 mm. wide . *metella* f. *gratilla.* (549)
(*p*) F.-w. subapical spots in 5 and 6 not separated by ground-colour . . *nemetes* f. *carpenteri.* (551)
F.-w. ditto separated by ground-colour, at least proximally. *q.*
(*q*) H.-w. discal band about 5 mm. wide and not markedly projecting outwards in area 5 . . . . . *saclava.* (546)
H.-w. ditto about 3 mm. wide and with prominent discal projection in area 5 *saclava* f. *marpessa.* (547)
(*r*) F.-w. cell dark above like ground-colour, or with only minute white dots, not with sharply defined streaks or spots (*trigonophora* sometimes has a diffused white streak in f.-w. cell above). *s.*
F.-w. cell contains more or less white, at least some part of which is sharply defined. *h′.*
(*s*) F.-w. discal band practically continuous from nervure 2 to, or nearly to, costa (nervule 4 may be rather blacker than the rest, but see footnote on *seeldrayersi*, p. 539). *t.*
F.-w. discal band discontinuous, generally owing to reduction of spot in area 4. *a′.*
(*t*) F.-w. cell on upperside has white dots. *u.*
Ditto rarely with faint paler markings, but not in the form of dots. *w.*

(*u*) F.-w. delicate submarginal lines are continuous, interrupted only by the nervules.	*v*.	
These lines less distinct between nervules 3 and 4	*agatha*.	(558)
	jordani.*	(560)
(*v*) H.-w. discal band extends beyond nervule 6	*seeldrayersi*.†	
H.-w. ditto does not extend beyond nervule 6	*livingstonei*.	(561)
(*w*) Proximal edge of f.-w. discal band straight.	*x*.	
Ditto concave or indented.	*z*.	
(*x*) F.-w. discal band sharply defined, the nervures only very faintly marked.	*y*.	
Discal band formed of elongated white spots rounded and deeply indented distally between nervules . .	*nysiades* (part).	(584)
(*y*) F.-w. discal band almost pyriform and pointed at costal end. Submarginal lines on both wings markedly white .	*nina*.	(580)
Ditto narrower towards costa, but not pyriform. Submarginal lines not so markedly white	*puella*.	(579)
(*z*) F.-w. band somewhat indented distally by ground-colour, especially in 3 and 4, band composed of spots of nearly equal length . . .	*nysiades* f. *continuata*.	(584)
Ditto with the spot in 2 very small and only touching that in 3 at its inner anterior angle	*nysiades* f. *metanira*.	(584)
Ditto with spots in 4, 5, and 6 considerably longer than those in 2 and 3 .	*nysiades* f. *conspicua*.	(584)
	nicomedes f. *puelloides*.‡	(579)

* No absolutely constant character can be given to distinguish these two species; *jordani* is smaller than the average size of *agatha*, and the ground-colour is paler. In *jordani* the discal band is more consistently narrowed towards the costa.

† Occasional examples of *seeldrayersi* have the f.-w. band separated into elongated spots by an increased blackening of the nervules. Such examples are distinguished from *nysiades* by the white dots in f.-w. cell above.

‡ *Puelloides* can generally be distinguished from *conspicua* by its smaller size and the interruption of the f.-w. submarginal lines in area 3 and often in 6.

(*a′*) F.-w. band does not reach costa, only just extending as a narrow longitudinal streak beyond nervule 6 .	*nysiades* f. *clarei*.	(584)
F.-w. band reaches costa or at least into area 8.	*b′*.	
(*b′*) F.-w. cell distinctly dotted with white.	*c′*.	
F.-w. cell dark, though rarely with vestiges of an ill-defined streak.	*e′*.	
(*c′*) White band of both wings very broad (6–10 mm.) and continuous from h.-w. inner margin to nervule 4 of f.-w. .	*kikideli*.	(569)
White band not so broad and distinctly interrupted in area 1*b*.	*d′*.	
(*d′*) The fine line just beyond the discal band is almost straight between the nervules	*rogersi*.	(568)
This line is well arched (proximally concave) between the nervules, especially in 2, 3, and 4	*barnsi*.*	(567)
(*e′*) On h.-w. underside distal to white band a row of large more or less rounded dark spots on a lighter ground-colour.	*f′*.	
Without such spots.	*g′*.	
(*f′*) H.-w. beneath with conspicuous costal white band extending from base to about middle of costa	*poultoni*.	(551)
H.-w. beneath with such band if visible at all very short and not extending along costa	*nemetes nemetes*.	(549)
(*g′*) In f.-w. cell beneath is an elongated curved clavate spot followed by two to four very small spots beyond cell .	*trigonophora*.	(570)
F.-w. beneath with an irregular narrow white mark along costal edge of cell and a transverse streak across end of cell	*nysiades* (part).	(584)
(*h′*) On h.-w. upperside the innermost of the three white submarginal lines is widened so as to form a conspicuous white band at least 2 mm. wide.	*i′*.	

* Strand's *nysiades urungensis* appears to come here, but there is no figure of it and the description is not sufficiently detailed to decide on its exact position. It may even turn out to be one of the above two species.

This line at most only slightly wider than the others, not more than 1 mm. *k′.*

(*i′*) A narrow but continuous longitudinal white stripe in f.-w. cell, but no transverse stripe . . . . . *rothschildi.* (574)

A transverse white stripe across end of f.-w. cell. *j′.*

(*j′*) F.-w. cell with a longitudinal white stripe . . . . *paula.* (574)

Ditto with three transverse marks progressively smaller proximally . . *biafra.* (571)

(*k′*) Discal band of f.-w. continuous from area 2 to, or nearly to costa, or only just interrupted by nervule 4. *l′.*

F.-w. band markedly interrupted at nervule 4. *m′.*

(*l′*) In f.-w., proximal edge of spots in 2 and 3 forms a straight line at or nearly at right angles to the long axis of spot in 4 . . . . . *nicomedes quintilla.* (579)

This proximal edge is S-shaped without a sharp angle . . . . . *nicomedes nicomedes.* (578)

(*m′*) White marks in f.-w. cell are transverse and usually three in number. (When very faintly developed=*nysiades* typical) . . . . . *nysiades* (part). (584)

White stripe in cell longitudinal. *n′.*

(*n′*) In f.-w. cell a white wedge-shaped mark followed distally by a contiguous triangular patch of greyish white scales . . . . . . *jamesoni.* (563)

Without such greyish patch (rarely with a few grey scales). *o′.*

(*o′*) Discal spot in area 4 of f.-w. is a mere narrow line touching nervule 5, such line nearly as long as the spot in 5 . . . . *nicoteles.* (576)

F.-w. discal spot in area 4 not of this form. *p′*

(*p′*) F.-w. spot in 4 well-developed and at least as long as that in 5 . . *strigata.* (582)

This spot, if present at all, very small and isolated. *q′.*

(*q′*) The white streak in f.-w. cell is long and narrow and just above the origin of nervule 3 is sharply indented anteriorly but not quite divided by the ground-colour. Beneath, this indentation usually contains a white dot . . . . . . *nebrodes.* (562)
F.-w. cell streak otherwise formed. *r′.*
(*r′*) F.-w. discal spots in 2 and 3 and in 5, 6, and 7 are not notably separated and so form two conspicuous white patches, very little white in cell . *melicerta* f. *goochi.* (581)
F.-w. discal spots divided by more or less complete invasions of the ground-colour. *s′.*
(*s′*) F.-w. discal spots 5 and 6 very short, almost rounded. Inner marginal spot obsolescent . . . . *nicobule.* (577)
F.-w. discal spots 5 and 6 elongated, inner marginal spot or spots well developed. *t′.*
(*t′*) White mark in f.-w. cell beneath followed distally by a curved white line parallel with its distal outline . *lermanni.* (564)
Without such line. *u′.*
(*u′*) A well-developed triangular spot just distal to f.-w. cell stripe . . . *melicerta.* (580)
Without such triangular spot . . { *mixophyes.* (576) / *nicodice.** (577) }

1. Neptis frobenia. Pl. XX, fig. 1; Pl. XXIV, fig. 1.

Fabr., Ent. Syst. Suppl., p. 425 (1798); God., Enc. Meth., 9, p. 430 (1823); Boisd., Faune Mad., p. 51 (1833); Trim., Trans. Ent. Soc. Lond., p. 335 (1866); Mab., Hist. Mad. Lep., 1, p. 170, pl. 20, f. 5, 6 (1885–7); Auriv., Rhop. Aeth., p. 166 (1898); in Seitz, Macrolep., p. 199, pl. 48c (1913).

* I can find nothing in the description of *nicodice* to distinguish it from *mixophyes* except its size. The former is said to have an expanse of 48 mm. and the latter 32 mm. Size is of little value in the genus. I have before me examples of *agatha* varying 20 mm. in expanse.

MAURITIUS.

Expanse about 38 mm. Ground-colour uniform umber brown. On f.-w. a narrow hind-marginal border very slightly paler followed inwardly by a second and sometimes a third slightly paler line. On inner margin near angle a small, not always well-defined spot of deep yellow, traversed by nervule 1. In areas 2 and 3 deep yellow spots forming a large ovate discal mark, its long axis nearly at right angles to costa. Three subapical spots of deep yellow forming a rather irregular mark in 5, 6, and 8, the middle spot the largest and that in 8 the smallest. On h.-w. a discal band of deep yellow almost pointed at anal angle, but widened gradually to nervule 4, thence somewhat narrower, and barely reaching the costa, its proximal edge nearly straight, its distal tending to concavities between the nervules. Marginal and submarginal narrow borders somewhat paler than ground-colour.

Underside. Paler and duller ground-colour. In f.-w. a trace of a white line across end of cell. In h.-w. the discal band white or faintly pinkish, sharply defined proximally, but distally shaded into ground-colour and followed by two pale zigzag lines whose angles lie on and between the nervules. In the male there is a silky opalescent area on inner margin of f.-w. extending to nervule 2.

Neptis frobenia is not very common in collections. It is easily identified and has a very different appearance from that of any other species. The male clasper is very like that of *comorarum*. Owing to lack of material I am unable to say whether the small differences shown in the drawing are constantly recognisable. Aurivillius gives Madagascar as a locality for this species, but there appears to be no record of its occurrence on that island.

2. NEPTIS DUMETORUM. Pl. XX, fig. 2; Pl. XXIV, fig. 2.

Boisd., Faune Mad., p. 50, pl. 7, f. 6 (1833); Mab., Hist. Mad. Lep., 1, p. 169, pl. 20, f. 3, 4 (1885–7); Oberth., Etud. d'Ent., 13, p. 14 (1890); Metamorph., Oberth., *l. c.* 12, p. 14, pl. 4, f. 2*c*, 2*d* (1888); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xxxiii (1908); Auriv., in Seitz, Macrolep., p. 199 (1913).

BOURBON.

Expanse about 45 mm. Ground-colour dark umber. Paler markings deep yellow. F.-w. with three minute white dots in cell

and three, sometimes four beyond it. A submarginal border consisting of two lines faintly darker than ground-colour, between which are developed minute white dots especially towards the apex. A small hind-marginal spot of deep yellow followed by a large discal spot in 2 and 3, more quadrate than in *frobenia*. A subapical spot made up of patches of nearly equal length in 5, 6, and 8. H.-w. with traces of a hind-marginal border of lighter and darker markings and with a discal band of deep yellow of sharply defined but irregular outline, not more than about 3 mm. wide at its broadest part, deeply concave between the nervules from 1*b* to 4 and projecting suddenly outwards in area 4.

Underside more or less reproducing the pattern of upperside, but ground-colour much paler and f.-w. hind-marginal and subapical spots nearly white, also a whitish transverse mark across end of cell. Hind-wing base with faint indications of pale spots, a curved row of small whitish spots in 4, 5, 6, and 7, followed by the discal band which is white or pinkish, sharply defined on both edges, and distally edged with dark brown followed by a greyish line. Slight indications of a double submarginal row of pale spots. Male with a pearly opalescent area in f.-w. extending from inner margin beyond nervule 2.

The following description of the larva is from Oberthür.

Originally fed on *Trajia reticulata*, but now feeds on *Acalypha marginata*, plants introduced from Mauritius. Larva pale chestnut. Flexed, about 22 mm. long. Six lateral membranous protuberances; the intermediate ones longer and projecting forward like horns. Three sublateral festoons edged with white and above the angle of the festoon white oblique marks. The last festoon rises posteriorly towards the caudal extremity, which ends in four fine points. Underside rose brown. The last segment has a pale shining mark of "arabesque" form. A paler median dorsal line arises from the prothorax and ends well before the caudal extremity.

The chrysalis is angular, short, flattened laterally, and projecting at the alar extremities. Gold pink tending to yellow or cream, opalescent. All the dorsal projections end in green points with a green iridescence. The prominent abdominal lines are touched with gold. The abdominal segments have a gold reflection.

Alleged occurrences of this species elsewhere than in the island of Bourbon seem unreliable. The male clasper resembles that of *comorarum*, but presents small differences which will be noted in the figure.

3. Neptis mayottensis. Pl. XX, fig. 3; Pl. XXIV, fig. 3.

Oberth., Etud. d'Ent., 13, p. 14, pl. 2, f. 10*a*, 10*b* (1890); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xxxv (1908); Auriv., in Seitz, Macrolep., p. 199, pl. 48*c* (1913).

Mayotte I.

Expanse about 35 mm. Ground-colour dark umber. F.-w. with three white dots in cell and three beyond. A submarginal border of two very slightly darker lines with paler marks between them which are resolved into distinct white dots towards the apex. A deep yellow inner-marginal patch in 1*a* and 1*b* continuous with the h.-w. discal band. A large patch of deep yellow in 2 and 3, and three subapical spots of same colour in 5, 6, and 8, the last very small. H.-w. with a broad dark yellow discal band 4 mm. wide and of regular outline. A submarginal border of two lines darker than ground-colour, the inner line twice the width of the outer.

Underside. Ground-colour paler. F.-w. large spots only slightly yellow, and the white dots accentuated. There are also two yellowish marks in cell and a transverse one at end of same. Traces of a second submarginal series of white dots beyond those which are also visible above. H.-w. irregularly marked in basal area with ill-defined whitish and yellowish spots, the discal band pinkish white and the space between it and hind margin occupied by a border consisting of internervular patches of dark brown shaded to reddish, each patch bounded proximally by a curved, and distally by a straight whitish line. Between the latter and margin a third very fine white line. The male has a pearly opalescent area in f.-w. reaching to nervule 2.

The female is paler and all the white dots more accentuated on both surfaces, so that on the upperside there is a complete submarginal series of these. In the h.-w. the discal band is broader. The male clasper except for its smaller size is very like that of *dumetorum*.

4. Neptis comorarum. Pl. XX, fig. 4; Pl. XXIV, fig. 4.

Oberth., Etud. d'Ent., 13, p. 14, pl. 2, f. 9*a*, 9*b* (1890); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xxxv (1908); Auriv., in Seitz, Macrolep., p. 199, pl. 48*a* (1913).

Grand Comoro.

comorarum leighi.

Roth., Novit. Zool., p. 341 (1918).

Anjouan I.

comorarum comorarum.

Expanse 35–45 mm. On the upperside this species resembles *mayottensis* with the exception that the f.-w. inner-marginal spot is nearly always absent, though out of some twenty-four examples before me, three or four have a slight trace of it.

The underside is also very similar, but in the male the f.-w. opalescent area extends well into area 2, while the space between the discal and subapical spots is reddish brown. There is also more reddish brown on h.-w., especially near costa.

comorarum leighi.

Differs from the type form in being smaller, the orange spots above paler, and the markings below less sharp and distinct.

The male clasper of the type form differs from that of its immediate allies in the greater development of the upper projection.

5. Neptis saclava. Pl. XXIV, fig. 5.

Boisd., Faune Mad., p. 49 (1833); Lucas in Chenu, Enc. H. N. Pap., p. 132, f. 248 (1853); Trimen, Rhop. Afr. Austr., p. 148, 338 (1862–66); Mab., Hist. Mad. Lep., 1, p. 173, pl. 20, f. 7, 8 (1885); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xxxv (1908); Auriv., in Seitz, Macrolep., p. 199, pl. 48*c* (1913).

Madagascar.

saclava marpessa. Pl. XX, fig. 5.

Hopff., Sitzb. Akad. Wiss. Berlin, p. 640 (1855); Peters, Reise Moss. Ins., p. 383, pl. 24, f. 9, 10 (1862); Trimen, S. Afr. Butt., 1, p. 272 (1887); Butl., Proc. Zool. Soc. Lond., p. 65 (1888); Auriv., Rhop. Aeth., p. 167 (1898); Butl., Proc. Zool. Soc. Lond., p. 921 (1900); Roth. & Jord., Novit. Zool., p. 536 (1903); Poulton, Proc. Ent. Soc. Lond., p. xxxv (1908); Rogers, Trans. Ent. Soc. Lond., p. 505 (1908); Neave, Proc. Zool. Soc., p. 33 (1910); Auriv., in

Seitz, *l. c.* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 160 (1920).

= *nemetes* var. *pasteuri*. Snellen, Tijdschr. Ent., xxv, p. 221 (1882).

AFRICA south of Sahara.

saclava saclava.

Expanse about 45 mm. Ground-colour dark sepia. Three white dots in cell and three or four beyond it. An inner marginal spot in 1*a* and 1*b* which may or may not be contiguous with a large white patch in 2 and 3. In area 4*a* a small distally placed white dot followed anteriorly by three white spots in 5, 6, and 8. These are separated from each other by the ground-colour, especially the first two, and the third on the costa is very small. The hind-marginal border consists of two fine whitish lines and sometimes a third close to the larger white marks, much interrupted at the nervules and broken into small spots. Between these and the large discal spots is a row of darker internervular markings sometimes tipped with white scales proximally. On h.-w. a broad white discal band about 4–5 mm. wide of fairly even outline but slightly, though not very markedly, projecting in area 5. Following the discal band there is a row of rather large more or less rounded dark internervular markings, followed again by two lines of equally dark but much narrower marks.

Underside. The white markings are repeated but in f.-w. the subapical patch is continued right to the costa by the addition of linear marks in areas 9 and 10, and these marks are lemon yellow. The ground-colour is variable and blotchy, reddish in cell and along the nervures, darker above central patch to costa, and at apex and between nervules 3 and 4. Externally adjacent to white markings is a row of dark spots, interrupted in area 5. On h.-w. the base is brownish with irregular pale marks. Distal to the discal band a row of dark internervular spots, proximally edged with white, of which those in 3 and 4 are largest. Beyond these, two rows of transverse internervular dark markings, also edged with white.

Male beneath has a pearly inner marginal area in f.-w. extending to nervule 2. The female also has a similar area, but of much smaller extent and generally hidden in average setting.

saclava marpessa.

This is the mainland form and is generally supposed to be distinguished by its narrower white markings, but I have before me W. African examples with the h.-w. discal

band broader than in the majority of those from Madagascar. The most constant difference between the mainland and the island forms is the marked projection in the former of the h.-w. discal band in area 5.

Saclava is unlikely to be confused with any other species except *nemetes*, but in the latter the subapical spots are coalescent, and the h.-w. discal band is continuous with the f.-w. white markings right up to nervule 4 of f.-w., at least on the proximal side. The male clasper of *saclava* is of the same type as in the yellow marked Madagascar species, though its upper projection is less highly developed. All these species are undoubtedly closely related. An interesting discussion by Prof. Poulton on the forms will be found in Proc. Ent. Soc. Lond., p. xxxv, 1908.

6. Neptis metella. Pl. XX, fig. 6; Pl. XXIV, fig. 6.

Doubl. & Hew., Gen. Di. Lep., p. 272, pl. 35, f. 2 (1850); Holl., Ent. News, 3, pl. 9, f. 3 (1892); Auriv., Rhop. Aeth., p. 166 (1898); Poulton, Proc. Ent. Soc. Lond., p. xl (1908); Auriv., in Seitz, Macrolep., p. 199, pl. 48*c* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 160 (1920).

S. Leone to V. Nyanza.

metella gratilla.

Mab., Ann. Ent. Belg., 23 Bull., p. 106 (1880); Hist. Mad. Lep., 1, p. 172, pl. 18*a*, f. 7 (1885–7); Auriv., Rhop. Aeth., p. 166 (1898); in Seitz, Macrolep., p. 200 (1913).

Madagascar.

metella metella.

Expanse about 45 mm. Ground-colour dark sepia. Markings white. In f.-w. cell a long prominent streak pointed at base, widest at cell end, projecting beyond, and again reduced to a point. In a few examples this streak is obsolescent. In most specimens there are two small marks just above outer point of cell streak. A small inner-marginal spot of variable size in 1*a* and 1*b*. Two large discal spots in 2 and 3 notably separated by nervule 3. In 4 two small spots, larger ones in 5 and 6, and a very small one in 8. Just distal to spots in 2 and 3, and 5 and 6, a white transverse line, variable and sometimes obsolescent. A hind-marginal border of two white lines variable and generally interrupted in 3.

H.-w. with a broad white discal band followed by dark interner-

vular markings, followed again by two pale lines variable and sometimes white.

On underside the f.-w. is deep yellow at base and for some distance along the costa, the ground-colour pale sepia brown and the white markings of the upperside are repeated but more distinctly. An irregular row of blackish spots beyond the discal white markings. The submarginal white lines, of which there are three, are thickened, and separated only by dark internervular streaks, though more or less completely interrupted in area 3.

H.-w. base yellowish with black spots. The discal band bordered by small internervular black spots followed by a row of larger rounded ones on a yellowish ground, followed again by two narrow black lines on a pale ground.

The male has an inner-marginal pearly white area on f.-w. extending to nervule 2.

metella gratilla.

The Madagascar form seems only to be distinguished by larger white markings, but examples before me from near Lagos are equally remarkable in this respect.

If the numbers received in general collections are of any proportional value *metella* would seem to be comparatively rare. The species cannot well be mistaken for any other with its combination of white streaked cell and h.-w. base beneath yellowish, spotted with black.

If we assume the structure of the male armature to be of value in estimating affinities, all the foregoing species would be regarded as closely allied members of an intergeneric group. They are more easily recognised by their outward characteristics than by the genitalia, which, though all very distinct from those of the rest of the genus, present but small constant differences *inter se.*

7. Neptis nemetes. Pl. XX, fig. 7.

Hew., Exot. Butt., Neptis, pl. 1, f. 1, 2 (1868); Holl., Ent. News, 3, pl. 9, f. 4 (1892); Karsch, Berl. Ent. Zeit., 38, p. 186 (1893); Auriv., Rhop. Aeth., p. 167 (1898); Neave, Proc. Zool. Soc. Lond., p. 33 (1910); Auriv., in Seitz, Macrolep., p. 200, pl. 48*c* (1913); Holl., Bull. Am. Mus. Nat. Hist., 160 (1920).

S. Leone to Uganda.

nemetes obtusa.

Roth. & Jord., Novit. Zool., p. 536 (1903).

SCHEKO.

nemetes f. *carpenteri*, f. nov. Pl. XXIV, fig. 7.

KAKINDU (W. of V. Nyanza). SEMLIKI VALLEY. UGANDA.

nemetes nemetes.

Expanse 40–45 mm. Sepia black with white markings. F.-w. with a white patch beginning at the inner margin and ending at nervule 4. The four spots constituting this patch are somewhat variable. In some forty examples before me they are always contiguous at least on the proximal side, and their inner edge forms a somewhat concave line continuous with the proximal edge of the h.-w. discal band. The spots in 2 and 3 project distally beyond those in 1*a* and 1*b*. In area 4 there is usually a small spot placed distally, and this is followed by a subapical white patch formed of three contiguous spots in 5, 6, and 9. In many examples there is an irregular, somewhat broken white line about 1·5 mm. from the other white markings and roughly following their outline. Beyond this are two, sometimes three delicate pale lines interrupted at the nervules and in area 3 and at apex. Fringes rather notably white between nervules except in 3 and 6.

H.-w. with a white discal band varying from 3 to 5 mm. in width. Beyond this band a row of rounded internervular spots rather darker than the ground-colour, followed by three pale lines which are in some specimens quite white and distinct. Fringes markedly white between the nervules.

Beneath, ground-colour pale. Costa white at base. In cell a white line running along subcostal nervure and curving over to form a transverse boundary at end of cell. Just beyond this boundary a second fine pale line, and beyond that a third. On median side of cell a short broken line. White patches as on upperside. White lines much more distinct, and irregular dark spots between discal patches and submarginal border lines.

H.-w. base brown with three transverse white lines, the first basal and continuous with subcostal line of f.-w. cell, the second broader and almost continuous with the median line of f.-w. cell, and the third narrow and hardly reaching the costa. Discal white band as above followed by a pale yellowish-brown line on ground-colour and a band of dark well-rounded internervular spots, which are shaded away outwardly, to be followed by a rather broad white line and two narrow ones, all divided by the nervules. Dark spots at nervule ends.

nemetes obtusa.

Messrs. Rothschild and Jordan's description of this form is as follows :—

Costal margin of f.-w. shorter than in *nemetes nemetes*, the wing appearing more obtuse. The white band in both wings much narrower, the inner edge of the band of the h.-w. crossing vein M just at point of origin of M1. Length of f.-w. 21 mm.

nemetes f. **carpenteri.**

There is no quite constant difference between the upperside of this form and that of *nemetes nemetes*, though in the latter the f.-w. spots in 2 and 3 tend to be longer. Beneath, the ground-colour and all the light markings, except the large white bands and spots, are more yellowish, thus bringing the dark rounded spots into greater prominence. The principal difference, however, is in the base of h.-w. cell beneath, which is not banded with white, but is of a yellowish ground-colour with more or less well-defined black spots.

There is no recognisable difference between the armatures of the typical form and f. *carpenteri*.

Except for the variability of the width and extent of the white markings *nemetes* is a fairly constant and easily recognised species. The only species likely to be confused with it is *N. poultoni*, which, however, can at once be distinguished by the conspicuous curved white costal band at base of h.-w. beneath. The form *carpenteri* seems to be the only one at Kakindu. Wherever it occurs it appears to be accompanied by *metella*, a fact which suggests a mimetic approach to that species in the pattern of h.-w. base beneath.

8. Neptis poultoni. Pl. XX, fig. 8; Pl. XXV, figs. 7, 8.

Eltr., Ent. Mo. Mag., Ser. 3, vol. vii, p. 26 (1921).

Uganda (Chagwe, Mabira Forest).

"Expanse 38-42 mm. Ground-colour dark sepia, with white discal markings. F.-w. with an inner marginal patch in 1*a* and 1*b* the proximal edge of which forms a straight line continuous with that of the h.-w. discal band. In 2 and 3 are large contiguous spots forming a subovate patch of regular outline. In area 4 a minute white dot placed distally. In 5, 6, and 10 contiguous spots forming a large subapical patch. Distal to the white markings and roughly following their contour a line somewhat paler than ground-colour, followed by

a band of more or less rounded dark internervular spots, this followed again by three paler lines forming the hind-marginal border. Fringes dotted white between nervules.

H.-w. with a white discal band of regular outline 4 mm. wide on inner margin, and rather broader in 5, thence narrowing to a small spot in 7. Distal to the white band a border similar to that in f.-w.

Underside. Ground-colour paler than above. Costa white at base and as far as cell end. In cell a white line on subcostal curving downwards and outwards, its end pointing to origin of nervule 3. On end of cell a white transverse line, and beyond this, indications of a second indistinct line. Discal white spots as above, but subapical extends into 10. The border arrangement of pale lines much accentuated owing to increased whiteness of lines and an additional fine marginal line.

H.-w. brown at base, but with a *conspicuous curved white costal bar from base to end of* 8, followed by two indistinct narrow whitish streaks on dark ground. Beyond discal band border of same pattern as in f.-w."

Neptis poultoni closely resembles *nemetes nemetes* Hew. and also, even more closely, *trigonophora* Butl. From *nemetes* it is at once distinguished by the curved white costal band in h.-w. underside, and from *trigonophora* by the underside pattern of the hind margins of both wings. The male armature is unlike that of any other species I have examined. In the note to my original description (*l. c.*) the word "costal" was unfortunately misprinted "distal."

9. Neptis incongrua. Pl. XX, fig. 9; Pl. XXIV, fig. 8.

Butl., Proc. Zool. Soc., p. 112, pl. 6, f. 2 (1896); *l. c.* (1896), p. 826 (1897); Auriv., Rhop. Aeth., p. 169 (1898); Auriv., Sjostedt Exp. Kilimandjaro, p. 6 (1910); Auriv., in Seitz, Macrolep., p. 203, pl. 48*f* (1913).

Dabida Hills. Mombasa. Kikuyu. Taita. Nyassaland. Tanganyika Ter. Lindi.

incongrua occidentalis.

Roth., Novit. Zool., p. 342 (1918).

90 km. W. of L. Albert Edward.

incongrua incongrua.

Expanse about 50 mm. Sepia black with white markings. F.-w. with two small hind-marginal spots in 1*a* and 1*b* separated by the nervure. Two spots in 2 and 3, the upper one the smaller. A subapical row of three spots, the first in 5, rounded, the second in

6, subquadrate, the third in 8, very small. Three small dots beyond cell. (One example in the Hope Dept. has an additional discal spot in area 4.)

H.-w. with a discal band of white spots about 3 mm. wide at broadest part extending from inner margin to area 6, the spots progressively more separated, that in 6 being small and rounded. Fringes of both wings white between nervules.

Underside chestnut brown. F.-w. without spots in cell, but with three small dots beyond it. Spots as on upperside but less separated, the two upper spots of subapical row fused together with an additional streak in 9. In male a pearly inner marginal area extending to nervule 2.

H.-w. with discal band as above, but more continuous and edged with sepia. Extreme margins and all nervures especially in h.-w. black. No internervular rays.

incongrua occidentalis.

Ground-colour greyer than in the type form. All the spots of f.-w. discal band wanting except those on each side of 1, 3, and 6, and these are much smaller. H.-w. band narrower. Both above and below there are dark internervular rays. Beneath the disc of f.-w. and outer fifth of h.-w. much deeper rufous.

Neptis incongrua is quite unlike any other species except *swynnertoni*, from which it differs in having smaller white marks and no spots in f.-w. cell.

I have examined the type of *incongrua occidentalis*, and though the great reduction of the white spots gives it a characteristic appearance, the male armature seems to resemble that of the type form within the limits of individual variation.

10. Neptis woodwardi. Pl. XX, fig. 10; Pl. XXIV, fig. 9.

Sharpe, Ann. Nat. Hist., (7) III, p. 243 (1899); Poulton, Trans. Ent. Soc., p. 512, pl. xxix, ff. 1, 2, 3, 4 (1908); Auriv., in Seitz, Macrolep., p. 203 (1913).

Uganda.

Expanse about 45 mm. Sepia brown with yellow and white markings. F.-w. with two spots in 2 and 3 which may be ochre yellow or white, and small subapical spots in 5, 6, and 8, the last very small. These are generally white.

H.-w. with a discal band of ochre yellow 3–4 mm. wide, rarely white, beginning just below nervule 2 and ending in 6. Fringes of both wings white between nervules.

Underside ochreous, brownish over central area in f.-w. and near apex of h.-w. Spots of f.-w. as above, but white and with an additional streak in 9. H.-w. discal band as above, sharply defined. In both wings fine dark internervular rays which are also visible above.

The colour of the lighter markings in this species is extremely variable. In some examples they are all white, but this appears to be due to fading. It is easily distinguished from all other species in so far as pattern is concerned, though the male clasper is doubtfully distinguishable from that of *ochracea*.

As Prof. Poulton has pointed out (*l. c. supra*) examples from E. of the Rift Valley show a greater mimetic approach towards *Amauris*, than specimens from more westward localities. The figures quoted should be referred to on this interesting point.

11. Neptis ochracea. Pl. XX, fig. 11; Pl. XXIV, fig. 10.

Neave, Novit. Zool., 11, p. 330, pl. 1, f. 5 (1904); Auriv., in Seitz, Macrolep., p. 203 (1913).

Toro. Entebbe. Kakindu.

ochracea f. *ochreata*.

Gaede, Int. Ent. Zeit. Guben, 9, p. 38 (1915).

= *exaleuca* var. *ochracea*. Grünb., Ergeb. Deut. Cent. Af. Exp. F. von Mecklenberg, 1907–8 (1912).
= *ochracea parvimacula*. Roth., Novit. Zool., p. 341 (1918).

Kwidgwi (L. Kivu).

ochracea f. *milbraedi*.

Gaede, *l. c.*, 9, p. 38, pl. 1, f. 3 (1915).

N. Cameroon.

ochracea ochracea.

Expanse 40–50 mm. Ground-colour dark to medium sepia brown with orange to pale ochreous areas. F.-w. with a broad patch of ochreous from inner margin to area 3, and a subapical patch of two subquadrate spots of the same colour in 5 and 6, sometimes followed by a small spot near costa. H.-w. with a broad ochreous discal band reaching to origin of 2, its proximal edge forming a continuous but not very regular line with that of the f.-w. inner marginal patch. Nervules and rays dark.

Underside pale dull ochreous, rather darker over basal half of f.-w. Paler marks as above, but h.-w. discal band reaches practically to base and is ill defined distally except in very dark specimens. Nervules and internervular rays well marked.

ochracea f. **ochreata.**

Differs from the type form in having the yellow bands narrower and the f.-w. discal band is interrupted in 1*b*. I have examined an example of the armature of Lord Rothschild's *parvimacula* and it is the same as that of *ochracea*. I cannot discover any difference in outward characters between forms *ochreata* and *parvimacula*, and both are described from the same locality.

f. **milbraedi.**

Differs from the type form in having the yellow bands rather broader and the costal spot wanting in f.-w. This latter point is no real distinction, as otherwise typical forms are without the spot.

The resemblance of *ochracea* to *exaleuca* in all but colour is very remarkable, and it is tempting to regard them as forms of the same species; nevertheless, although the armature of *exaleuca* is variable, I have not found an example approaching agreement with that of *exaleuca*.

12. Neptis exaleuca. Pl. XX, fig. 12; Pl. XXIV, fig. 11.

Karsch, Berl. Ent. Zeit., 39, p. 9, f. 5 (1894); Auriv., Rhop. Aeth., p. 169 (1898); Auriv., in Seitz, Macrolep., p. 202 (1913); Holl. (*Neptidomima*), Bull. Mus. Am. Nat. Hist., p. 164 (1920).

Cameroon. Congo.

exaleuca suffusa.

Roth., Novit. Zool., p. 341 (1918).

95 km. W. of L. Albert Edward (3250 ft.).

exaleuca f. *integra*, f. nov.

Toro.

exaleuca exaleuca.

Expanse 45–50 mm. Ground-colour dark sepia with white markings. The description of the upperside of *ochracea* applies to this species if we substitute white for ochreous patches, and add that there is a break in the inner-marginal patch in area 1*b*. The

pale marks are somewhat smaller than in *ochracea* and distally more sharply defined. Beneath, the ground-colour is pale sepia, but the base of both wings is orange ochreous, and the h.-w. band is very sharply defined, being bounded distally, especially as far as 3, by a fine line darker than the ground-colour.

exaleuca suffusa.

Ground-colour is much darker and the f.-w. patches on each side of 1 and 3 much smaller. The underside is strongly marked with rufous orange.

The male clasper of *exaleuca* is of a very unstable pattern. It differs from that of *ochracea* in the form of the projection on the upperside of the clasper. In *woodwardi*, *ochracea*, and *incongrua* this is extended into a prominent upward and backwardly curved hook. In *exaleuca*, of which I have made several preparations, the hook is very small in one example. In another there is one very small hook on the left clasper and two on the right. In none of my preparations is there any approach to the great development of the hook found in the other species or in *nemetes*. The armature of *exaleuca suffusa* is somewhat intermediate to that of *ochracea* in having a slight development of the upturned hook, but the claspers of *exaleuca suffusa* are not more different from those of *exaleuca exaleuca* than different examples of the latter are from each other.

exaleuca f. **integra.**

Differs from typical *exaleuca* in having no definite interval of ground-colour between spot in f.-w. $1a$ and that in 2. The male clasper is of the same type as those of the typical form.

13. Neptis swynnertoni. Pl. XXI, fig. 1; Pl. XXIV, fig. 12.

Trim., Proc. Ent. Soc. Lond., p. xxviii (1912).

S. E. Rhodesia (Mt. Chirinda).

subsp. *neavei*.

Roth., Novit. Zool., p. 342 (1918).

Nyassaland (Mt. Mlanje).

swynnertoni swynnertoni.

Expanse 40–50 mm. Ground-colour sepia black, with white

markings. F.-w. with three small white spots in cell and four beyond it. A very small inner marginal spot not always extending beyond 1*a*. A large patch of two spots in 2 and 3, its proximal and distal margins forming nearly parallel lines at right angles to the costa. A rounded spot in 5, a subquadrate in 6, and a very small spot in 8.

H.-w. with a discal white band about 5 mm. wide beginning about middle of inner margin and ending, considerably reduced in width, in area 6. All fringes white between nervules.

Underside chestnut brown. White markings as above, but with an extra subapical spot on costa. The h.-w. discal band outlined with darker colour.

The principal distinction between this species and *incongrua* is the presence of white spots in the f.-w. cell, and the large coalescent spots in f.-w. 2 and 3. Whilst the external characters suggest a very close relationship to *incongrua*, the male clasper is so different from that of the other species of the group as to suggest only a very slight affinity. That the clasper of *incongrua* should present a far closer resemblance to that of *nemetes* than to that of *swynnertoni* is a good example of the difficulties presented by this genus.

Trimen (*l. c.*) regards this species together with *incongrua*, *exaleuca*, and *woodwardi* as allied to the Palaearctic species *lucilla* Fab.

swynnertoni neavei.

Whilst the type of this form in Lord Rothschild's collection differs in certain small points from the few examples of *swynnertoni* we have at Oxford, examination of a small series of Mlanje specimens in the national collection shows that such differences are not constant. Perhaps the least inconstant feature is the absence of well-marked internervular rays on the h.-w. underside in *neavei*.

I strongly suspect that when Lord Rothschild described *neavei* he had not seen an example of *swynnertoni*, otherwise he would not have compared it with *exaleuca*, with which it has little in common. Indeed, it is difficult to separate *neavei* from *swynnertoni* on any outward character, but the fact remains that the male armatures are different, at least according to the few preparations I have been able to make from these rare forms.

The clasper of *swynnertoni* is shown at Pl. XXIV, fig. 12. Those of examples from Mlanje (= *neavei*) differ in having an upturned hook at the extremity, somewhat like that of

ochracea, though less developed. My friend Dr. S. A. Neave tells me that the fauna of Chirinda and Mlanje present great similarities, and the explanation of the present case seems a simple one. The same species, *swynnertoni* has become isolated in the two elevated regions. On Mlanje the clasper has developed an upturned hook. Doubtless in course of time other modifications will arise, and what are now probably forms of the same thing will ultimately become two definitely separate species.

14. NEPTIS AGATHA. Pl. XXI, fig. 2; Pl. XXIV, fig. 13.

Stoll, Cramer Pap. Exot., 4, p. 76, pl. 327, f. A, B (1780); Hopffer, Peters Reise Moss. Ins., p. 383 (1862); Staud., Exot. Schmett., 1, p. 146, pl. 50 (1885–6); Trim., S. Afr. Butt., 1, p. 270 (1887); Karsch, Berl. Ent. Zeit., 38, p. 186 (1893); Auriv., Rhop. Aeth., p. 167 (1898); Roth. & Jord., Novit. Zool., p. 536 (1903); Rogers, Trans. Ent. Soc. Lond., p. 505 (1908); Neave, Proc. Zool. Soc., p. 33 (text fig.) (1910); Auriv., in Seitz, Macrolep., p. 200, pl. 48*d* (1913); Longstaff, Trans. Ent. Soc. Lond., p. 21 (1913); *l. c.* p. 275 (1916); Holl., Bull. Am. Mus. Nat. Hist., p. 160, pl. vi, ff. 7, 8 (1920).

= *melicerta*. Fab., Syst. Ent., p. 508 (1775); Godt., Enc. Meth., 9, p. 432 (1823); Trim., Rhop. Afr. Aust., p. 146 (1862).
= *agathe*. Herbst, Naturs. Schmett., 9, p. 86, pl. 238, f. 7, 8 (1798).

AFRICA S. of Sahara.

agatha ab. *lativittata*.

(*N. lativittata*) Strand, Archiv. f. Naturg., 75, 1, p. 305 (1909).

With type form.

agatha agatha.

Expanse 35–50 mm. Sepia black with white markings. F.-w. with three to four or five dots in cell. A hind-marginal patch of two spots in 1*a* and 1*b*, a discal band of spots from 2 to costa, sometimes quite continuous, sometimes interrupted slightly by nervules, the outer edge forming a fairly regular convex curve, the inner straighter but usually indented at nervule 4. Distal to this band a line rather paler than ground-colour and sometimes bearing a few white scales,

this followed by three lines of transverse internervular white streaks interrupted by the nervules and more completely broken (very rarely unbroken) in area 3. Fringes of both wings white between nervules.

H.-w. with a white discal band of variable width, but usually about 5 to 6 mm. extending from middle of inner margin to area 6. Beyond this the ground-colour rather paler, then darker, and finally a submarginal border of three fine white lines, broken only by the nervules.

Underside. Sepia brown. F.-w. white at base of costa, a variable series of spots in cell and two or three beyond it. Discal band as above, but rather broader. The pale line beyond it broader than above, but more diffuse. The white marginal lines much more pronounced, the first expanded into triangular spots near apex. Often a fourth line along hind margin. Interruption in area 3 sometimes complete, sometimes scarcely evident.

H.-w. with a white costal band, followed by two others, the first of which travels well along costa where it is broken into spots. Pale line beyond the discal band often with a slightly ochreous appearance. First (proximal) submarginal line much widened, all more distinct than above, and often a fourth line at margin.

agatha lativittata.

The white markings of more than average extent.

Neptis agatha is by far the commonest and most widely distributed species in the African region. The species with which it is liable to be confused are *jordani*, *livingstonei*, *barnsi*, and *seeldrayersi*. No absolutely constant characters can be given to distinguish *jordani*, but its characteristics so far as they can be described will be found under that species. The form *livingstonei* is unknown to me. The published figure shows the h.-w. discal band extending only to area 5, and this seems to be the principal distinction. The two species *barnsi* and *seeldrayersi* are distinguishable by small features thereunder described. It is unfortunate that the interruption of the f.-w. submarginal lines in area 3 is not an absolutely constant character, some examples referable to the *lativittata* form having practically continuous lines. This condition is, however, rare and the interrupted lines will almost always serve to distinguish *agatha* from the other species named, with the exception of *jordani*, which also has this feature. Holland (*l. c.*) points out that there is generally a difference between

examples taken in woodlands and those from more open country, the latter being smaller and having a broader white band.

For the sake of completeness I should mention here a form provisionally named *urungensis* by Strand (Mitt. Zool. Berl. V, p. 287 (1911)), and placed by Aurivillius as a form of *nysiades* (Macrolep., p. 201 (1913)). Strand mentions (*l. c.*) two examples resembling Neave's *conspicua*, one of which is distinguished from typical *conspicua* in having well-defined white dots in cell on upperside. The remainder of the description is quite useless as a means of identification, and the author states that should it prove to be a definite form he proposes the name *urungensis*. In my opinion this kind of half-description and provisional nomenclature should not be valid as founding a name of any kind. If the example in question has distinct white dots in cell it certainly cannot be a form of *conspicua*. I place it here merely because it suggests, though only vaguely, something allied to *agatha*.

15. NEPTIS JORDANI. Pl. XXI, fig. 3; Pl. XXIV, fig. 14.

Neave, Proc. Zool. Soc. Lond., p. 33, pl. 2, f. 1 (and text fig.) (1910); Auriv., in Seitz, Macrolep., p. 200, pl. 48*d* (*agatha* ab.) (1913); (?) Holl., (as *agatha*) Ent. News, pl. 9, f. 2 (1892).

CHISHI I. (L. Banguelo). KATANGA (Kambove). BOUSSA (Kassai R.). ARUWIMI. NYASSA. VICTORIA FALLS.

A detailed description would follow so closely that of *agatha* that it would seem of more use to state as fully as possible the directions in which it differs from that species. I have before me a series of thirty-six examples. In general appearance the ground-colour is browner than *agatha*. The f.-w. discal band is very complete and shows no blackening at the nervules. In practically every case the white spot in area 4 is longer than that in area 5, whereas in *agatha* 4 is generally shorter than 5. In *jordani* the white in 6 is so markedly shorter than that in 5 that the whole band has a narrowed appearance towards the costa, an effect much less apparent in *agatha*. The distal margin of the discal band from nervule 4 to the costa presents on the whole a straight or even concave line, whereas in *agatha* such margin is convex. In h.-w. the white of the discal band projects outwardly between the nervules, especially in 4 and 5, and the ends of such projections are well rounded. In *agatha* the ends of the

component white spots are generally cut off nearly straight, and they are not liable to so prominent a projection in 4 and 5. This feature is perhaps even more evident on the underside.

This species was noted in the field by Dr. Neave as being apparently distinct from *agatha*. He states that it was decidedly local, frequenting hot dry localities, and having a more restless, active, and less floating flight.

16. Neptis livingstonei.

Suffert, Iris, 17, p. 126, pl. 3, f. 10 (1904); Auriv., in Seitz, Macrolep., p. 200 (1913).

E. Africa (Lukuledi).

Suffert's description is as follows :—

Length of body 16 mm. Expanse 44 mm. Body blackish above, grey below. Upperside. Ground-colour grey black, markings white. F.-w. discal band formed of six spots in 2–6 and 9, proximally fairly straight and sharply defined from the ground-colour. Distally curved and not well defined. At nervule 4 on both sides an indentation, the nervule very black and slightly dividing the band. An inner marginal spot in 1*a* and 1*b*, 6 mm. wide at margin, rounded anteriorly, rather nearer the margin than the base. Three round dots in cell and two elongated spots at cell end. Four transverse submarginal lines, the first—counting from base outwards—just beyond discal band, very diffuse, formed of obsolescent whitish spots, the second consisting of eight more distinct white streaks broadly interrupted by the ground-colour, the third of eight narrow loosely connected streaks, the last very slender and scarcely recognisable. Fringes black, white between nervules.

H.-w. with a discal band of seven spots in 1*a* to 5; proximal edge well defined, the distal in 1*a* to 2 also well defined, in 3 to 5 suffused. The two first lines very indistinct, rather showing through from beneath, the third narrow, in 1*c* to 6 distally rounded, the outermost also narrow and closely approximated. Fringes black, white between nervules.

Underside. F.-w. ground-colour and markings generally as above, with the exception of the cell which shows seven spots, and four dots in base of 4 to 6 and 10, between cell end and discal band. The four submarginal lines heavier than above.

H.-w. discal band and lines as above, latter more distinct. Three basal bands, the first extending along costa to middle of 8. The second from inner margin to base of nervules 7 and 8 and extending slightly into area 7, the outermost from 1*a* at inner margin through

cell a little above base of nervules 5 and 6, into area 5; at end of this band a small spot in the same area.

I have found no example of this form amongst the hundreds of specimens examined. The description and figure suggest a rather aberrant example of *jordani*, though without an examination of the male armature it is impossible certainly to determine its specific identity.

17. Neptis nebrodes. Pl. XXI, fig. 4; Pl. XXIV, fig. 15.

Hew., Ent. Mo. Mag., 10, p. 206 (1874); Holl., Ent. News, 3, pl. 9, f. 1 (1892); Auriv., Rhop. Aeth., p. 169 (1898); in Seitz, Macrolep., p. 202 (1913).

S. Leone. Lagos. Ogowe. Angola. Cameroon.

Expanse 55–60 mm. Sepia brown with white markings. Upperside; f.-w. with an elongated white mark in cell, sharply pointed at base, widest at cell end, and extending into area 4 to within about 1 mm. of the discal spot in 3, where it is narrowed again and comes to a rather indefinite termination. Just above origin of nervule 3 this cell streak has a slight indentation on its costal side. In the majority of examples a minute white spot close to costa near the middle of its length. A small rather elongated inner-marginal patch formed of two spots in 1*a* and 1*b*, followed by two large subquadrate spots in 2 and 3 just separated by nervule 2, and outwardly rather divergent. In 4 a small triangular spot or streak distally placed. In 5, 6, and 9 elongated rather divergent spots, the last very small. Distal to this series of markings a pale line roughly following their contour and interrupted at the nervules. Following this a series of three pale submarginal lines, the first often rather well marked, and all interrupted by the nervules. Fringes of both wings white between nervules.

H.-w. with a well-defined white discal band 5–6 mm. wide, from middle of inner margin to area 6, where it is much narrowed. Close to the distal edge of this band a pale ill-defined line about 1 mm. wide, followed by three pale submarginal lines, the first suffused and about 2 mm. wide, the second very narrow and better defined, the last still narrower.

Underside. Ground-colour rather paler. F.-w. white at base of costa. Cell almost entirely filled with white, and a very small streak at origin of 5 and 6. The indentation in the costal side of the cell mark noted above, here contains a small white dot. Some white scales in base of area 3, several small streaks above cell end. White discal marks as above. Remaining lines much more distinct than on upperside.

H.-w. Base ground-colour with a white costal mark about 4 mm. long, followed by two curved white bands which coalesce near origin of 6. Discal band as above followed by broken whitish line which curls inwards in area 6 and follows costa for some distance. Three submarginal lines as above, but the innermost widened out into a band of large subquadrate spots, the second about 1 mm. wide, and the third very fine, all quite white.

The most distinctive feature of this species is the indentation of the white cell mark, and especially the white dot therein on the underside. Perhaps this character alone is sufficient to distinguish it from other described species.

18. Neptis jamesoni. Pl. XXI, fig. 5; Pl. XXIV, fig. 16.

Godm., Story of the Relief Expedt., p. 436 (1891); Auriv., Ent. Tidskr., 15, p. 283 (1894); Rhop. Aeth., p. 169 (1898); in Seitz, Macrolep., p. 202, pl. 48*f* (1913).

Lagos. Cameroon. Congo Region.

Expanse 55–65 mm. Sepia black with white and blue-grey markings. F.-w. with a large white mark in cell pointed at base and wide at end of cell, beyond which is a terminal patch of pale blue grey (sometimes separated). The extreme base of the white mark and as far as origin of nervule 2, also blue grey. A large white innermarginal mark consisting of two spots in 1*a* and 1*b*, about 6 mm. long and slightly separated distally. A subtriangular mark in 2 rather distally placed and separated, especially outwardly, from a longer quadrate spot in 3. In 4 a small distal triangular spot, and a subapical series of three elongated spots distally divergent in 5, 6, and 9. Beyond this discal series a delicate line of whitish or blue-grey scales, interrupted at nervules, followed by two similar submarginal lines, the first the more distinct. Fringes of both wings white between the nervules.

H.-w. with white discal band about 6 mm. wide narrowing where it ends in area 6. Near it, distally, a pale line, and beyond it two, sometimes three submarginal lines, the first often distinctly white, the others very narrow and sometimes rather indistinct.

Underside. Ground-colour only little paler than above. F.-w. white at base on costa. Cell with a large pyriform mark cut off rather suddenly at cell end, and immediately followed by a white transverse mark, and a second more or less crescentic spot at base of area 4. Two or three small streaks near costa above end of cell. Other white marks as above but more accentuated. No blue-grey scales. First line beyond discal spots well marked but less pure white than the rest. An additional fine line at margin.

H.-w. with a narrow white costal band from base to rather beyond middle of costa, followed by two white bands the second rather broken and irregular. Discal white band as above followed by a narrow brownish-white line which curves inwards at 6 and travels proximally to join the costal band. The submarginal lines much more distinct than above, the innermost some 2 mm. wide and well-defined.

I have seen but few examples of this species. The blue-grey marks in cell will usually suffice to distinguish it from other forms. It can be distinguished from *nebrodes* by the absence of the anterior notch in f.-w. cell mark, and from *lermanni* by the more elongated divergent f.-w. subapical spots.

19. Neptis lermanni. Pl. XXI, fig. 6; Pl. XXIV, fig. 17.

Auriv., Öfvers. Vet. Akad. Förhandl., 53, p. 431 (1896); Rhop. Aeth., p. 168, pl. 1, f. 8 (1898); in Seitz, Macrolep., p. 202, pl. 48*f* (1913); Holl., Bull. Am. Mus. Nat. Hist. p. 164 (1920).

Congo Region.

Expanse 50–60 mm. Ground-colour dark sepia with white markings. F.-w. with a large white pyriform mark in cell. This mark is generally rather ill defined, not always extending to base, where, however, the ground-colour is generally dusted with blue-grey scales, some of which are also found at the distal end of mark. Beyond this at base of area 4 an ill-defined spot largely composed of pale-grey scales. An inner-marginal patch of two spots in 1*a* and 1*b*, two subovate spots in 2 and 3, separated by nervules, a small triangular spot distally placed in 4, three spots in 5, 6, and 9 slightly separated by nervules and shorter than in *jamesoni*. Following these discal marks a pale line interrupted by the nervules, and three more or less white submarginal lines.

H.-w. with a discal white band about 6 mm. wide from inner margin to area 6, where it is rounded off and narrower. Distal to this a pale line, and three submarginal lines as in f.-w.

Underside little paler than above. F.-w. white at base of costa. Cell mark more fully developed, though tending to an invasion of the ground-colour along basal part of median. Just distal to end of cell mark a curved transverse line followed by a small ill-defined spot, and above this faint traces of small spots near costa. White discal marks as above, that in 4 not more developed than on upperside. Submarginal border lines well developed, and traces of an extra line at margin.

H.-w. with white at base extending as a fine line to middle of costa, followed by a white band incompletely divided into two. Discal band as above followed by a brownish white line which curves round at 6 to meet costal line. Submarginal lines well developed, especially the innermost, which forms a band some 2·5 to 3 mm. wide broken only by the nervules.

Judged both by the pattern and the structure of the male armature *lermanni* is very closely allied to *jamesoni*. From the few examples I have seen the ground-colour is rather browner, and the fore-wing cell mark is without the well-developed distal patch of blue-grey scales. The species is extremely rare in collections.

The six foregoing species all have the male clasper of a form characterised by a single pointed projection (in *jordani* there is an additional inwardly directed point not visible in the figure). The external patterns do not support the view that these species are more closely allied than others of the genus. Indeed, as we shall see, there are other species whose patterns appear to be much more closely allied to that of *agatha*, but of which the male armatures are of a totally different form.

20. Neptis seeldrayersi. Pl. XXI, fig. 7; Pl. XXV, figs. 5, 6.

Auriv., Ent. Nachr., 21, p. 379 (1895); Rhop. Aeth., p. 167, pl. 1, f. 7 (1898); Auriv., in Seitz, Macrolep., p. 200, pl. 48*d* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 161 (1920).

Kumasi to Mombasa.

Expanse 45–60 mm. Sepia black with white markings. F.-w. with three white spots in cell and from one to five beyond it. An inner-marginal patch formed by two spots in 1*a* and 1*b*, usually coalescent, or at most only divided by the nervule. A discal band of white spots in 2 to 6 and 9. This band may be quite continuous, with the nervules only just visible, or it may be distinctly separated into spots, distally somewhat divergent. The tendency to separation is greatest on nervule 4, but the spot in 4, though it may be narrow, is not appreciably reduced in length (differing in this respect from *rogersi* and *barnsi*). Distal to the discal band and following its contour a pale line well marked or faint, not thrown into distinct arches between the nervules. Three submarginal lines, the first

more or less expanded into spots near apex (rarely traces of a fourth near apex). These lines, however faint, are interrupted only by the nervules and never markedly obsolescent in area 3.

H.-w. with a white discal band beginning at inner margin and usually ending in area 6, but sometimes extending into area 7. Its proximal margin forms an almost continuous straight line with the f.-w. inner-marginal patch as far as the median nervure, whence it turns downwards towards the anal angle. This discal band varies in width from 4 to 10 mm. and may be quite continuous, even the nervules being white, or it may consist of spots separated by black nervules, and distally still more so by invasions of the ground-colour. Beyond this band a pale line often only faintly indicated, followed by three, sometimes four submarginal lines. Both wings with white spotted fringes.

Underside. Ground-colour little paler than above. F.-w. white at base of costa. Pattern in cell variable but usually consisting of a white mark on subcostal side with a small proximal and a larger distal posterior projection, between which are two rather faint spots. Following this an irregular line across end of cell. Several small spots above cell end. White discal marks as above, the first line yellowish white, the submarginal lines much accentuated, the most proximal one being widened into subtriangular spots towards apex.

H.-w. with a conspicuous white basal band extending along costa nearly to middle of its length, followed by two rather well-defined white bands. These are much more regular and less broken than in *agatha*. Discal band as above. First pale line well developed and yellowish white. Submarginal lines similar to those on f.-w., the most proximal being expanded into subquadrate spots.

There seems no absolutely constant character by which *seeldrayersi* can certainly be distinguished from *agatha*. The most useful is the continuity of the submarginal lines on the upperside of the f.-w. All examples of *seeldrayersi* seem to be constant in this respect, though rare specimens of *agatha* seem also to have uninterrupted lines. When this occurs in *agatha* it seems to be accompanied by a much paler ground-colour, whereas *seeldrayersi* is nearly always very dark sepia to black. The regularity of the white bands on the base of h.-w. underside is also a useful feature, these in *agatha* being almost always broken and irregular.

N. seeldrayersi is not very rare in collections but is frequently overlooked owing to its resemblance to *agatha*,

amongst long series of which a few examples may often be discovered.

21. Neptis barnsi. Pl. XXI, fig. 8; Pl. XXIV, fig. 18.

Eltr., Ent. Mo. Mag., Ser. 3, vol. vii, p. 27 (1921).

Congo Region to Semliki Valley. Kisumu.

"Expanse 55–60 mm. Ground-colour sepia black with white markings. Five white dots in cell of fore-wing, and traces of two minute dots beyond. An inner-marginal white patch of two elongated spots in 1*a* and 1*b*, their proximal edges straight, outer ends slightly separated. In 2 and 3 two white marks, proximally just separated by nervule 3, but distally more widely divergent. In area 4 an obsolescent white streak (in some co-types well developed). In 5 and 6 elongated spots divided by nervule 6 and distally divergent. A small spot in 9 near costa. Distal to white markings and roughly following their contour a fine line of bluish-grey scales which is thrown into a series of arches between the nervules. Following this, three bluish-grey lines continuous except at the nervules. Fringes spotted white between the nervules.

"Hind-wing with a discal white band about 5 mm. wide, rather narrower at inner margin, slightly projecting proximally at median, and extending to area 6. Distal edge of band indented on nervules by the ground-colour and slightly powdered with black between. Three bluish-grey submarginal lines as on fore-wing, and midway between the innermost of these and the discal band a narrow line somewhat paler than the ground-colour.

"Underside. Ground-colour paler than above. Fore-wing costa white at base and nearly to cell end. In cell a series of rather complicated white markings, consisting of a basal streak terminating in a spot, a transverse streak, two small spots, and two at each cell end. Beyond this, three or four very small spots. Large white marks as on upperside, that in 4 more fully developed, the pale lines all much more accentuated but white, not bluish-grey, and there is a trace of an additional fine line at and below the apex.

"Hind-wing with a large curved white costal band from base nearly to end of 8, followed by two less definite white bands on the brown ground-colour. Discal band as on upperside, and rest as on fore-wing."

This species closely resembles *seeldrayersi* Auriv., from which it may generally be distinguished by the obsolescent character of the streak in fore-wing area 4, and by the fact that the pale line on fore-wing immediately distal to the

discal markings is deeply arched (distally convex) between the nervules. The male armature is quite distinct from that of any other described species.

22. Neptis rogersi. Pl. XXI, fig. 9.

Eltr., Ent. Mo. Mag. Ser. 3, vol. vii, p. 29 (1921).

Rabai.

"Expanse about 50 mm. Sepia black with white markings. Fore-wing cell with three or four white dots and three beyond it. An inner-marginal white patch of two spots in 1*a* and 1*b*. Two large subquadrate spots in 2 and 3 separated proximally by the nervule, and distally by a slight invasion of the ground-colour. In 4 a small subtriangular spot, distally placed. Three subapical spots in 5, 6, and 9, the first two subquadrate, distally divergent, and the third a small streak. Just distal to the white discal marks a white line roughly following their contour. This line is not arched between the nervules. Following this, two fine submarginal lines with faint indications of a third, the first breaking into three small but rather conspicuous spots near the costa.

"Hind-wing with a white discal band 7–8 mm. wide, straight, and sharply defined proximally, regular but invaded by the black nervules distally. The outer edge of the band is closely followed by a pale line, and there are three more pale lines forming a marginal border. Fringes white between nervules.

"Underside. Not markedly paler than above. All the lighter markings chalky white. Fore-wing with white at base of costa and a complicated pattern of lines and spots in cell. In the type form there is in the cell a line along the subcostal having two downward projections, between which is a small spot. Just beyond end of this line another spot, and on the median side three spots, one longitudinal and two transverse. Four or five small spots beyond cell. (In the co-type two of the spots coalesce to form a transverse line across cell end.) The spot in 4 is very little larger beneath than above, but more sharply defined and definitely triangular. The discal and submarginal lines are broader and more distinct, only separated by fine dark lines.

"Hind-wing with a curved white costal band, but this much narrower than in *barnsi* and *seeldrayersi*. This followed by two very distinct curved white bands. White discal band very broad and extending from inner margin to area 7. Other lines as on fore-wing."

I hesitate to describe a species from ♀♀ only, but the

two examples from which the above account is compiled do not correspond with any other forms in the collections which I have examined. They are at once distinguished from *agatha* and *seeldrayersi* by the small spot in fore-wing area 4, whilst they differ from *barnsi* in the straight formation of the fore-wing discal line bordering on the large white spots. Also in the much narrower hind-wing basal costal band and in the pure white markings of the underside.

23. NEPTIS KIKIDELI. Pl. XXI, fig. 10; Pl. XXV, fig. 1.

Boisd., Faune Mad., p. 50 (1833); Mab., Hist. Mad. Lep., 1, p. 171, pl. 20, ff. 9, 10 (1885–7); Trim., S. Af. Butt., 1, p. 271 (1887); Auriv., Rhop. Aeth., p. 167 (1898); in Seitz, Macrolep., p. 200, pl. 48*d* (1913).

MADAGASCAR.

Expanse 30–57 mm. Sepia black with white markings. In f.-w. three dots in cell and sometimes one to four beyond it. A large discal white patch extending from inner margin to nervule 4 and of variable outline. In area 4 a small spot distally placed, sometimes absent. A subapical patch of three or four spots in 5, 6, and 9 or 5, 6, 8, and 9. Discal and submarginal lines extremely variable and generally obsolescent in areas 3 and 6. Fringes of both wings white between nervules.

H.-w. with a broad white discal band 6–11 mm. wide, the proximal margin of which is continuous with the f.-w. inner-marginal patch. This band extends from inner margin to area 7 or even to costa. Distally it may be of smooth outline or indented at nervules; in the latter case the internervular white marks are well rounded. Discal and marginal lines variable, sometimes scarcely evident.

Underside. Ground-colour rather paler. F.-w. white at base of costa. Cell very irregularly spotted with white, and three or four spots beyond it. White marks as above but larger. The pale discal line little developed or absent. The first submarginal widened into a band of spots conspicuously interrupted in 3 and 6.

H.-w. with a white streak at base of costa extending to end of discal band. Discal band as above. The first marginal line expanded into a row of spots and followed by one and sometimes two narrow lines.

This species may be recognised by the fact that the white markings are continuous from inner margin to nervule 4. Also it is confined to Madagascar, where it is apparently not uncommon.

It is a remarkable fact that the male armature is not constantly distinguishable from that of *trigonophora*, a species to which it bears no close resemblance.

24. NEPTIS TRIGONOPHORA. Pl. XXII, fig. 1; Pl. XXV, fig. 2.

Butler, Ann. Nat. Hist., (5), 2, p. 177 (1878); Auriv., Rhop. Aeth., p. 169 (1898); Butler, Proc. Zool. Soc. Lond., p. 913 (1900) (? *lermanni*); Auriv., in Seitz, Macrolep., p. 201, pl. 48*e* (1913).

E. and S. AFRICA (Rabai to Pondoland).

Expanse 45–50 mm. Sepia black with white markings. F.-w. without white dots, but sometimes with vestiges of a longitudinal streak. An inner-marginal patch in 1*a* and 1*b*, followed by two spots in 2 and 3 slightly separated distally. In 4 a very small spot distally placed, and in 5, 6, and 9 three white spots distally separated, the third very small and streak-like. A pale discal line following the contour of the discal spots. Three delicate but usually well-defined submarginal lines.

H.-w. with a white discal band from inner margin to area 7, straight proximally and very slightly indented distally at nervules. This followed by a pale discal line and three, sometimes four submarginal lines, the innermost of these brownish, the rest extremely fine and scaled with white.

Underside. F.-w. very slightly white at base of costa, a curved clavate white mark in cell, its distal end often bordered by a delicate pale curved transverse line. Beyond this four rather ill-defined spots. White discal marks as above, followed by a well-developed pale line of a yellowish tinge and four white submarginal lines, the first about 1 mm. wide.

H.-w. with a small narrow white streak at base of costa, followed by two curved well-defined white lines. Discal band as above followed by a yellowish line and four submarginal white lines. All fringes white between nervules.

N. trigonophora is not likely to be mistaken for any other species except *strigata*, which, however, has a fully developed spot in area 4, almost invariably a white streak in cell on upperside, and has a large broad white band on h.-w. underside at base of costa. Some forms of the *nysiades* group resemble it, but these have transverse white lines in f.-w. cell beneath. Whilst individual examples of the male armature may show differences from that of *kikideli*,

an examination of several preparations convinces me that it would be impossible to decide on the anatomy alone between the two species, if indeed they are really specifically distinct. The case is the more remarkable in that whilst the armatures are so similar they are entirely different from that of any other species examined.

25. Neptis biafra. Pl. XXII, fig. 2 (*prox.*).

Ward, Ent. Mo. Mag., 8, p. 121 (1871); Afr. Lep., p. 12, pl. 9, ff. 1, 2 (1874); Auriv., Rhop. Aeth., p. 168 (1898); Auriv., in Seitz, Macrolep., p. 201 (1913); Holl., Bull. Am. Mus. Nat. Hist., pl. 8, f. 3 (1920) (*prox.*); *Non* Holl., Ent. News, pl. 9, f. 10 (1892).

Cameroon.

Ward's description of this species is as follows :—

Male. Upperside. Both wings brown black; f.-w. the cell crossed by three diagonal white marks, the outer one the largest, the inner one near the base the smallest; beyond the cell three parallel horizontal white streaks, the upper one the smallest; below midway two clear oval white spots; h.-w. crossed midway by a broad band of white, this band is also continued slightly into the f.-w.; fringe of both wings white; following the outer margin of both wings four white bands, the first from the margin very narrow, second rather broader, third broad especially on the h.-w., fourth narrow and rather undulating on the h.-w.

Underside resembles upperside, with the white markings generally broader. Expanse 2·3 in.

Ward's figure, which is rather rough, agrees with the above description. I have never seen an example exactly like the figure, and certainly there is no specimen in the four great British collections. The most characteristic features are the three white marks in f.-w. cell, in which it differs from *paula*, which has one diagonal and one longitudinal mark, and the secondary white band in the h.-w. Unfortunately the type has been lost, M. Oberthür informing me that it was missing when he acquired Ward's collection. The species, if it be a species, has been much confused with other forms, especially owing to the figure published by Dr. Holland (Ent. News, *supra*). This figure represents a form but little removed from typical *nysiades*. This error was sufficiently confusing, but the same author has only

recently (1920, *l. c.*) reasserted that this figure represents Ward's *biafra.* M. Oberthür has kindly sent me a photograph of Ward's figure, and it agrees with the copy we have at Oxford.

The differences between Ward's figure and that of Dr. Holland (Ent. News, 1892) are as follows :—

Ward's Figure.	Holland's Figure.
F.-w. cell with white transverse spot near base followed by a longer transverse mark and a long transverse streak across end of cell.	Three white dots in cell, the outermost rather elongated.
Of the three anterior discal white streaks in f.-w. that nearest costa is very small and faint.	This streak though smaller than the rest is well developed.
Following the discal band of spots is a very distinct though slender white line.	This line obsolescent.
Following the above slender line a well-developed white line formed of spots gradually increasing in size as they approach costa, till that in 6 is quite a large spot 7 × 1·5 mm.	Corresponding line very faint.
H.-w. white discal band about 6 mm. wide.	Ditto about 4 mm.
Following the discal band is a narrow white line arched in 1*a*, 2, 3, and 4 proximally convex.	No such line present.
Distal to above line a band of white spots, their proximal outline well arched (proximally convex). This band is quite 2 mm. wide in 2 and 3.	Only a faint line in this position.

It will thus be seen that whether the insect figured by Holland in 1892 be a form of *biafra* or not, it certainly differs greatly from Ward's own figure of the species.

Dr. Holland, in spite of his emphatic assertions to the

contrary, seems to have had some doubt in the matter, since in Bull. Am. Mus. Nat. Hist. pl. 8, 1920, he publishes another figure of "*biafra*" which agrees neither with his own previous illustration nor with that of Ward. It approaches more nearly to the latter in having the secondary white band on the h.-w., though this is much narrower than in Ward's figure. This 1920 figure rather supports the view that *biafra* is yet another form of the polymorphic *nysiades*, since I have before me examples of the latter which are very close to the figure in question.

Since the above was written, M. Ch. Oberthür has most kindly sent me three specimens which it was hoped might elucidate the mystery. One of these agrees so closely with Ward's original figure that I have illustrated it at fig. 2, Pl. XXII. Practically the only difference between it and Ward's specimen is that in the latter the secondary submarginal white band in h.-w. is rather broader than in M. Oberthür's example. The second of M. Oberthür's examples differs in having a still narrower secondary h.-w. band, indeed it is reduced to a mere line, whilst the third example has the h.-w. white markings so reduced that this secondary band is a mere pale suffusion.

Now it is most unfortunate that this third example, least like Ward's species, is the only male, the other two being females: hence the structure of the armature in an example almost exactly like Ward's figure remains unknown. I have made a preparation of the armature in this one male, and it is of a very simple character, somewhat intermediate between that of a form of *nysiades* and *paula*.

Now whilst the two specimens, one male and one female, which are less like true *biafra*, certainly belong to the same species, the female example which comes so close to Ward's figure is probably specifically different. If the figure on Pl. XXII be carefully examined, it will be noted that in f.-w. just beyond the discal white marks there is a distinct but delicate white line (most easily seen in the left wing). This line is deeply arched in 2, 3, and 4. The corresponding line in the other two specimens is scarcely arched at all; indeed, in one of them it is perfectly straight in area 2. Before we can be sure of the true affinities of these forms much more material is necessary. In the meantime it would appear that Ward's *biafra* is probably a good species, and that forms belonging to the *nysiades* association resemble it very closely.

26. Neptis paula. Pl. XXII, fig. 3; Pl. XXV, fig. 3.

Staud., Iris, 8, p. 368, pl. 8, f. 2 (1896); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201, pl. 48*f* (1913).

S. Leone. Lagos.

Expanse 40–55 mm. Sepia black with white markings. F.-w. with a subclavate mark in cell followed by a transverse mark, beyond which are three longitudinal stripes in 4, 5, and 6, the first long, the last short and very narrow, and all distally divergent. An inner-marginal patch of two spots in 1*a* and 1*b*, and two discal spots, a larger and a smaller in 2 and 3. These discal marks immediately followed by a delicate white line. Beyond this a line of white spots, transverse and linear in 1*b* to 3, crescentic in 4 and 5, and longitudinal and linear towards costa. Beyond this two fine submarginal lines broken by the nervules.

H.-w. with white discal band from inner margin to 6, about 4 mm. wide followed by a faint pale line. Beyond this a secondary discal band of white subquadrate spots followed by two very fine submarginal lines.

Underside as above, but all white markings more extensive. F.-w. with white at base of costa extending to a point below origin of 2 in f.-w. Traces of an additional fine marginal line in both wings.

N. paula is not rare in collections. The male armature is of so simple a character as to offer little suggestion in regard to affinity. The species has been bred from a pupa found by Lamborn near Lagos. The pupal skin is in the Hope Collection. The hind and inner margins of the wing-cases project so as to form prominent lateral ridges, and on the head there are two bifurcated horn-like projections.

27. Neptis rothschildi. Pl. XXII, fig. 4; Pl. XXV, fig. 4.

Eltr., Ent. Mo. Mag., Ser. 3, vol. vii, p. 28 (1921).

Congo Region (Kassai, Kingour Forest).

"Expanse 50–55 mm. Sepia black with white markings. Forewing with a white cell streak, beginning at base and passing between nervures 4 and 5 to a point considerably beyond the origin of 3. Elongated inner-marginal spots in 1*a* and 1*b*, distinctly separated. Two similar discal spots in 2 and 3 still more separated.

A white dot distally placed in area 4, and a series of three well-separated elongated spots or streaks in 5, 6, and 9. Distal to these discal spots and following their contour a very fine line of greyish-white scales. Beyond this a well-developed white line, broken into spots by the nervules. Finally two delicate submarginal lines.

"Hind-wing with a discal band about 3–4 mm. wide from inner margin to nervule 6, the spots of which are distinctly separated by the nervules. Distal to this a very faint line, rather paler than the ground-colour, followed by a narrow white secondary band of quadrate spots separated by the nervules. Two delicate submarginal lines.

"Underside. Pattern of upperside repeated, but the white marks more pronounced on a paler ground. Fore-wing white on costa at base. Cell streak larger and more sharply outlined. Above end of cell two or three additional white streaks. White submarginal bands much more distinct, especially inner one, which is widened to about 1·5 mm., and there is an extra distal line at apex.

"Hind-wing with a white costal band from base to middle of costa. The secondary discal band composed of spots much larger than above."

This species most nearly resembles *paula* Staud., but is quite differently marked in fore-wing cell above and below. Ward's *biafra* is also similar, but has three transverse white stripes in cell. All three differ from other described species in having a secondary white discal band on the hind-wing. The male clasper of the present species is quite different from that of *paula*.

28. Neptis sextilla.

Mab., Le Natural., 2, p. 99 (1882); Hist. Mad. Lep., 1, p. 174 (1887); Auriv., Rhop. Aeth., p. 167 (1898); in Seitz, Macrolep., p. 201 (1913).

Madagascar.

I am unable to give any information with regard to this species beyond Mabille's description. The latter refers to a figure on a plate which appears never to have been published. The author describes it as allied both to *saclava* and *kikideli*. It would seem unnecessary to reprint here the original description, which though lengthy unfortunately gives little idea of the appearance of the insect. Aurivillius in Seitz (*l. c.*) places it next after *paula*, though merely on probability. The type is apparently unknown, and so far no other example has been noted.

29. Neptis nicoteles. Pl. XXII, fig. 5; Pl. XXV, fig. 9.

Hew., Ent. Mo. Mag., 10, p. 206 (1874); Holl., Ent. News, 3, pl. 9, f. 8 (1892); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 202, pl. 48*e* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 163 (1920).

S. Leone to Angola. Cameroon to Mombasa.

Expanse 37–42 mm. Ground-colour sepia black with white markings. F.-w. with a white clavate mark nearly filling cell. An inner-marginal patch in 1*a* and 1*b* followed by a more or less rounded patch of two spots in 2 and 3. A subapical patch of white in 4, 5, 6, and 9. In 4 this patch begins only just below nervule 5, so that the spot in that area is a mere streak. The discal marks followed by a pale line, beyond which are three delicate whitish submarginal lines. Fringes white between nervules.

H.-w. with a discal white band from inner margin to area 6 about 5 mm. wide, almost straight on both edges, nervules thereon not or very little blackened. Discal and marginal lines as on f.-w.

Underside. F.-w. just noticeably white at base of costa. H.-w. with a white streak at base of costa followed by two more on the dark ground of basal area. Other marks as above, but white submarginal lines much more accentuated.

This little species is apparently not very common. It may be distinguished from others by the streak of white below and adjacent to nervule 5 in f.-w.

30. Neptis mixophyes. Pl. XXII, fig. 7.

Holl., Ent. News, 3, p. 249, pl. 9, f. 11 (1892); Auriv., Rhop. Aeth., p. 169 (1898); in Seitz, Macrolep., p. 202 (1913).

? = *nicodice.* Grünb., Sitzb. Ges. Naturf. Fr. Berl., p. 470 (1910).

Bipindi. Ogowe.

Expanse 32–42 mm. Sepia black with white markings. F.-w. with white mark in cell, the edges of which are straight and the end pointed. An inner-marginal patch of two spots in 1*a* and 1*b*, followed by two subquadrate marks in 2 and 3, slightly separated. In 4 a small distally placed triangular spot, two separated elongated spots in 5 and 6, and a small mark in 9. Beyond these discal marks a fine white line broken at nervules and bent deeply inwards in 1*b*. Two whitish submarginal lines interrupted only by the nervules, and indications of a third on the margin. All fringes white between nervules.

H.-w. with a white discal band about 5 mm. wide, straight proximally, and outwardly rather indented at nervules. This followed by a pale discal line, and two or three submarginal lines.

Underside. F.-w. as above but white marks more accentuated. No white at base of costa. H.-w. with slender white line on costa at base, followed by two more, the first broad, the second narrow and faint. Beyond the discal band the pale line forms a distinct row of whitish spots, and the first marginal line is widened into conspicuous white spots, the others broader and more distinct than above.

I can find nothing in Grünberg's description of his *nicodice* to distinguish it from *mixophyes*, and there is but little except the continuity of the f.-w. submarginal lines to distinguish either from *nicobule*. However, as this is the principal distinction between *agatha* and *seeldrayersi*, it may be that *nicobule* is a separate species. Lack of material, all three forms being rare, has prevented me from making comparative preparations of the male armature, the only example available and apparently belonging to this species, is a female. The figure on Pl. XXII is really a photograph of Holland's figure. I included this rather than the actual specimen in my possession, since the latter does not agree absolutely with Holland's figure, having an additional spot in f.-w. on costa.

31. Neptis nicobule. Pl. XXII, fig. 6; Pl. XXV, fig. 10.

Holl., Ent. News, 3, p. 249, pl. 9, f. 7 (1892); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 202 (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 164 (1920).

S. Leone to Angola.

A full description of this species would be almost a repetition of that of *mixophyes*, and it will suffice to call attention to the slight differences. In Holland's original figure the f.-w. cell mark is clavate and well rounded distally instead of straight sided and pointed. The discal spots are small and rounded instead of elongated, and the submarginal lines are notably interrupted in 3. From an examination of the rather scanty material at my disposal I am inclined to think that the f.-w. submarginal lines furnish almost the only difference, and without much longer series I am unable to say whether even this is constant.

32. Neptis nicomedes. Pl. XXII, fig. 8; Pl. XXV, fig. 11.

Hew., Ent. Mo. Mag., 10, p. 205 (1874); Kirby, Handb. Lep., 1, p. 147, pl. 20, f. 3 (1894); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913).

Ashanti to Angola. Uganda.

f. *quintilla.* Pl. XXII, fig. 9.

Mab., Ann. Ent. Fr., (6), 10, p. 21, pl. 2, f. 7 (1890); Auriv., Ent. Tidskr., 15, p. 284 (1894) (as *nicomedes*); Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 162 (1920).

Lagos. Ivory Coast. Cameroon. Angola. Kassai. Entebbe.

f. *puelloides*, f. nov. Pl. XXII, fig. 10.

Lagos. Gold Coast. Kampala.

nicomedes nicomedes.

Expanse about 38 mm. Sepia black with white markings. F.-w. with a white mark in cell sometimes clavate extending from near base, widening and curving over downwards and outwards to end of cell, sometimes divided into two, the basal part remaining only as a dot. On inner margin a white mark in 1*a* and 1*b*, the marginal part rather wide and the inner edge forming a continuous straight line with that of h.-w. discal band. A large continuous white discal band from 2 to 9, its outer and inner edges regularly curved, proximally concave, distally convex. Beyond this a pale line, faint or well developed, followed by a narrow white line which is usually expanded into a spot near apex. Two delicate submarginal lines, more or less interrupted in area 3, especially beneath.

H.-w. with a broad discal band about 5 mm. wide, both edges rather straight, and nearly parallel, extending from inner margin to 6, this followed by a pale line and three submarginal lines.

Underside. The clavate mark in f.-w. cell better developed than above, and sometimes with a faint pale transverse line beyond it. Base at costa faintly white. Other marks as above but marginal pattern whiter, and interruption of lines more obvious in 3, and often in 6.

H.-w. with a conspicuous curved white band at base of costa, extending to middle of same, followed by two narrow lines, the lower rather longer than the upper. Other markings as above but marginal lines more developed.

nicomedes quintilla.

Resembles type form, but the spots in f.-w. 2 and 3 are short and quadrate, so that the contour of the inner edge of the discal patch is materially altered. All stages of intermediates occur.

nicomedes puelloides.

F.-w. cell without any trace of white mark, and on underside the white in cell is reduced to a line on subcostal which curves sharply downwards and outwards at cell end. Just beyond this a transverse white line. The spots in f.-w. 2 and 3 vary in length, so that the proximal edge of discal patch may be of the type form or may approach that of *quintilla*. This form bears a close resemblance to *puella*, but may generally be distinguished therefrom by the proximal edge of the f.-w. discal band, which in *nicomedes* is concave or even indented, whilst in *puella* it is straight or even convex. Also in *puella* there is no interruption in the f.-w. submarginal lines. The interruption of the f.-w. lines is the sole distinction apart from the armature between *nicomedes* f. *puelloides* and certain forms which appear to be conspecific with *nysiades* f. *continuata*.

Type Hope Collection, Oxford. Taken by Lamborn at Oni, Lagos, Dec. 1911.

33. Neptis puella. Pl. XXII, fig. 11; Pl. XXV, fig. 12.

Auriv., Ent. Tidskr., 15, p. 285, f. 11 (1894); Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913).

Cameroon. Congo. Uganda.

Expanse about 35 mm. Sepia black with white markings. F.-w. without marks in cell. An inner-marginal patch in 1*a* and 1*b*, its inner edge quite or nearly continuous with that of h.-w. discal band. A large continuous discal patch from 2 to 9, the inner edge of which is either straight or convex. This patch not or but little reduced in width till just before reaching costa, where the spot in 9 is very small. The usual discal pale line followed by three fine whitish or bluish-grey submarginal lines, these interrupted only at nervules. Fringes white between nervules.

H.-w. with large discal patch, continuous and with smooth outline followed by discal and submarginal lines as on f.-w.

Underside. F.-w. as above but white markings especially submarginal lines much accentuated. Costa whitish at base. In cell a longitudinal streak on subcostal, followed by a diagonal line across end of cell.

H.-w. with large white curved band on costa from base to a point just above end of proximal edge of discal band, followed by two narrow whitish lines. Otherwise as above with pale lines accentuated, the discal line brownish white.

This species may be distinguished by its small size and by the large continuous discal patch in f.-w. The straight or convex proximal edge of this patch and the uninterrupted submarginal lines distinguish it from *nicomedes puelloides*.

34. Neptis nina. Pl. XXV, fig. 13.

Staud., Iris, 8, p. 369, pl. 8, f. 1 (1896); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913).

E. Africa (Usagara).

Expanse about 30–35 mm. Resembles *puella*, but the f.-w. discal patch is smaller and rapidly narrows from area 4 almost to a point in 6. The discal pale line very faint, but the first submarginal line well developed and expanded into spots towards apex. The submarginal lines interrupted in 3 especially beneath. First submarginal line on h.-w. also formed of distinct white streaks.

I have seen but two examples of this species. Aurivillius regards it as a race of *puella*, but if the structure of the armature is constant then it must be given specific rank. It is easily recognised and not at all like any other form except *puella*, from which it differs as above described.

35. Neptis melicerta. Pl. XXIII, fig. 1; Pl. XXV, fig. 14.

Drury, Ill. Exot. Ins., 2, p. 34, pl. 19, ff. 3, 4 (1773); Herbst, Naturs. Schmett., 9, p. 84, pl. 238, ff. 5, 6 (1798); Staud., Exot. Schmett., 1. p. 147 (1886); Holl., Ent. News, 3, pl. 9, f. 5 (1892); Karsch, Berl. Ent. Zeit., 38, p. 186 (1893); Auriv., Rhop. Aeth., p. 169 (1898); Roth. & Jord., Novit. Zool., p. 537 (1903); Rogers, Trans. Ent. Soc. Lond., p. 505 (1908); Neave, Proc. Zool. Soc., p. 33 (1910); Auriv., in Seitz, Macrolep., p. 202, pl. 48*e* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 164 (1920).

= *blandina*. Cramer, Pap. Exot., 4, p. 76, pl. 327, ff. E, F (1872).

= *melinoe*, God., Enc. Meth., 9, p. 432 (1823).

S. Leone to Uganda.

subsp. *goochi*. Pl. XXIII, fig. 2.

Trimen. Trans. Ent. Soc. Lond., p. 336 (1879); S. Afr.

Butt., 1, p. 273, pl. 5, f. 6 (1887); Butl., Proc. Zool. Soc., p. 65 (1888); Auriv., Rhop. Aeth., p. 169 (1898); Neave, Proc. Zool. Soc., p. 34 (1910); Auriv., in Seitz, Macrolep., p. 202, pl. 48*f* (*not typical*) (1913).

E. Africa to Natal.

melicerta melicerta.

Expanse 30–55 mm. Sepia black with white markings. F.-w. with a large white mark in cell, wedge shaped, sometimes suffused on subcostal side, cut off rather sharply at distal end, and followed closely by a white triangular mark; this sometimes faint, and rarely joined to cell mark at posterior corner. On inner margin a white streak-like mark in 1*a* with a second smaller one in 1*b*, these generally confluent. In 2 and 3 two elongated white marks, usually separated by broadly blackened nervule. In 4 a small spot distally placed, and in 5, 6, and 9 three elongated spots, the first two generally well separated. Following these discal marks a pale line of variable distinctness beyond which are three delicate marginal lines, they and the white marks on fringes being more or less interrupted in area 3 and often in 6.

H.-w. with a white discal band, proximal edge of which is very straight, and continuous with that of the f.-w. inner-marginal spots. Distal edge moderately straight, but often indented at the nervules. A pale discal line followed by internervular marks rather darker than ground-colour, then another pale line (the first of the marginal series), and finally two delicate but usually well-defined marginal lines.

Underside. F.-w. just perceptibly white at base of costa, other markings as above on a rather paler ground, but pale lines much accentuated. An additional marginal line which with the others is notably interrupted in 3.

H.-w. with a short white curved band at base, followed by two straighter lines on the dark ground. Other markings as above but pale lines more distinct, and an additional one on margin.

melicerta goochi.

This form differs from the type in having the f.-w. discal spots more confluent, and in particular in the obsolescent character of the cell mark. The typical *goochi* is really an intermediate between two more definite forms, the one having all white marks fully developed (= Auriv. fig. *l. c. supra*) and the discal spots confluent, the other having the f.-w. cell mark reduced to a spot at the distal end, and the discal spots only rather more confluent than in the typical form. All kinds of intermediates occur, though the prevalence of the diminished cell-spot form in S. and E. perhaps entitles it to subspecific rank.

Neptis melicerta is very common and easily recognised. The male armature is of a simple structure not particularly constant and but little distinctive. The species has been bred by both Lamborn and Farquharson. Only the pupal skins are preserved. They show, though to a less extent than in that of *paula*, the expansion of the wing-cases, and appear to have only a single horn-like projection on the head.

36. NEPTIS STRIGATA. Pl. XXIII, fig. 3; Pl. XXV, fig. 15.

Auriv., Ent. Tidskr., 15, p. 284, f. 10 (1894); Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201, pl. 48*e* (1913); Holl., Bull. Am. Mus. Nat. Hist., p. 163 (1920).

CAMEROON to UGANDA and S. SUDAN.

Expanse 45–50 mm. Rich sepia black with white markings. F.-w. with a white mark in cell, rather variable, but on the whole clavate. When well developed, of curved pyriform outline. A large inner-marginal patch of two spots in 1*a* and 1*b*, the inner edge of which is not usually continuous with that of the h.-w. discal band. Two rather short outwardly rounded spots in 2 and 3, tending to be separated distally, and a subapical patch of four spots in 4, 5, 6 and 9, confluent or but little separated. These followed by a pale line and three submarginal lines, the first of which is developed into a diagonal streak or streaks near the apex. Marginal lines interrupted only by the nervules. Fringes white in internervular spaces.

H.-w. with a white discal band about 6 mm. wide from inner margin to 6, where it is rounded off. Following this a line rather paler than the ground-colour, and three delicate submarginal lines.

Underside. Ground-colour paler, white marks more developed. F.-w. faintly white at base of costa. Clavate mark in cell followed by a pale or white longitiudinal mark, sometimes with traces of diagonal streaks above it near costa. The first submarginal line on both wings developed into a band of spots. Traces of an additional line at apex.

H.-w. with conspicuous basal white band from base of costa to about the middle of its length, followed by two narrow white bands, the second much larger than the first.

N. strigata is easily distinguished on outward characteristics, but its specific distinction is very doubtful, the male armature being quite indistinguishable from that of a peculiar form of *nysiades* which I have dissected. This *nysiades* form nearly resembles Holland's *continuata*.

I have now described at length all the species or forms of *Neptis* which can with moderate certainty be distinguished. There remains a residuum of forms which seem to merge one into another in such a way as to render it impossible to separate them specifically even by the male armature. If we examine a series of preparations of the genitalia taken from these forms, and then arrange our preparations in the order of their resemblance, we shall find a great difference in structure between the first and the last of the series, but no satisfactory distinction between any two or three consecutive examples. Moreover, if we then arrange the specimens themselves we shall find that their patterns do not by any means follow the resemblance of the armatures. Thus, as already stated, the armature of *strigata* is indistinguishable from that of a form very near Holland's *continuata*. Some examples of Neave's *conspicua* have armatures which resemble those of typical *nysiades* sufficiently to warrant us in agreeing with Aurivillius, who regards them as conspecific. But one of Neave's co-types of *conspicua* has an armature of a slightly different pattern, whilst the type of *conspicua* itself has the two claspers of the same individual very different in structure. It is impossible to deal on ordinary taxonomic lines with an assemblage of this kind. It is useless to decide that a given example is the same as Holland's *continuata* because it resembles the published figure of that form. We do not know the structure of the armature in the type. A specimen outwardly indistinguishable from *conspicua* may, as I have shown, possess claspers of a different structure, or, since the armature of the type specimen is asymmetrical, we might have two examples outwardly resembling *conspicua* one of which had claspers like the right one of the type, the other with claspers like the left.

In our classifications we attempt to work in what may be metaphorically termed watertight compartments. Nature, though frequently conniving at our methods, refuses always to be bound by them, and we must, I think, decide more freely to admit the existence of indeterminate forms. We have an outstanding example of this in the many indefinite forms which are comprised under the specific name *Acraea acrita*, as set forth in my monograph of the genus *Acraea* (Trans. Ent. Soc., 1912). I propose therefore to give a description of a typical example of *Neptis nysiades*, to detail also the other named patterns which

appear to be associated with it, and finally to give the characteristics of several specimens which, as above explained, I consider must for the present at least be regarded as indeterminate forms of the same species. Such forms come within our definition of a species if we assume that they constitute what Prof. Poulton has termed a syngamic chain (Proc. Ent. Soc., p. cxvi, 1903), in which consecutive links are apparently capable of pairing, although the terminal elements may be too far specialised to admit of intercourse, and this not necessarily in relation to any special geographical distribution. Indeed, in cases of this kind syngamic "complex" would be more expressive than "chain."

37. Neptis nysiades. Pl. XXIII, fig. 4 (nearly typical); Pl. XXV, figs. 16, 17.

Hew., Exot. Butt., (*Neptis*) pl. 1, ff. 3, 4 (1868); Trimen, S. Af. Butt., 1, p. 271 (1887); Auriv., Ent. Tidskr., 15, p. 285 (1894); Holl., Ent. News, 3, pl. 9, f. 10 (1892) (*prox.*) (as *biafra*); Auriv., Rhop. Aeth., p. 167 (1898); in Seitz, Macrolep., p. 200, pl. 48*e* (*prox.*) (1913).

Lagos to Uganda.

f. *metanira*. Pl. XXV, fig. 20.

Holl., Ent. News, 3, p. 249, pl. 9, f. 6 (1892); Auriv., Rhop. Aeth., p. 167 (1898); in Seitz, Macrolep., p. 201 (1913).

Congo Region to Uganda.

f. *continuata*. Pl. XXIII, fig. 8.

Holl., Ent. News, 3, p. 249, pl. 9, f. 9 (1892) (as *biafra continuata*); Auriv., Rhop. Aeth., p. 168 (1898); in Seitz, Macrolep., p. 201 (1913).

Congo to Uganda.

f. *clarei*. Pl. XXIII, fig. 6.

Neave, Novit. Zool., 11, p. 330. pl. 1, f. 15 (1904); Auriv., in Seitz, Macrolep., p. 201 (1913).

Nyangori.

f. *conspicua*. Pl. XXIII, fig. 7; Pl. XXV, figs. 18, 19.

Neave, Novit. Zool., 11, p. 329, pl. 1, f. 15 (1904); Proc.

Zool. Soc., p. 34 (1910); Auriv., in Seitz, Macrolep., p. 201 (1913).

Togo to Uganda.

nysiades nysiades.

Examples precisely agreeing with Hewitson's type are rare. In it there is a small streak and a dot in f.-w. cell, an inner-marginal patch of which the proximal edge is continuous with that of the h.-w. discal band. Two short separated subquadrate spots in 2 and 3, and a subapical series of four in 4, 5, 6, and 9, slightly separated by the nervules, followed by the usual pale discal and submarginal lines, the latter not interrupted in area 3.

Beneath the f.-w. has a basal streak followed by two diagonal streaks, and the h.-w. has a white costal mark at base, followed by two less distinct whitish lines. All pale discal and submarginal lines more distinct than above. Expanse about 40–50 mm.

From this typical form we pass to a modification of much more frequent occurrence (Pl. XXIII, fig. 5) very closely resembling the figure in Seitz quoted above, pl. 48*e*. This form may be recognised by the much larger discal spots in f.-w., especially the subapical series which are very long (about 8 mm. in area 4) and distally divergent. The pale lines often well marked and white, the first of the submarginal series developed into spots towards apex. The f.-w. cell marks are characteristic, consisting of a spot near base, followed by a short and then a longer diagonal stripe. On the underside the first two marks are joined to form a subcostal line having a small projection about the middle of its length and bent sharply downwards and outwards at its end. This followed by a well-marked diagonal stripe at cell end. This form is very like *strigata* except for the different arrangement of cell marks. (Though for the present I have kept *strigata* separate it is probably only another form of *nysiades*.)

The form *clarei* differs in having the subapical series of f.-w. spots ending in a faint streak just beyond nervule 6 on upperside, thus leaving a rather conspicuous area of ground-colour between the subapical series and the costa. The subapical spots are but little separated, and the inner marginal patch is basally prolonged, so that its proximal edge is not continuous with that of the h.-w. discal band. There are no white marks in f.-w. cell above.

From this we pass through intermediate forms in which the f.-w. spots become less and less separated to the type

of f. *conspicua*, in which the discal spots are all joined and form a continuous patch from area 2 to 9. In the type the spots in 2 and 3 are proximally shorter than in 4, so that the inner edge of the patch is sharply angulated on nervule 4. (Very small examples of the *conspicua* form are extremely like *nicomedes puelloides*, but can be distinguished by the continuity of the f.-w. lines in area 3.)

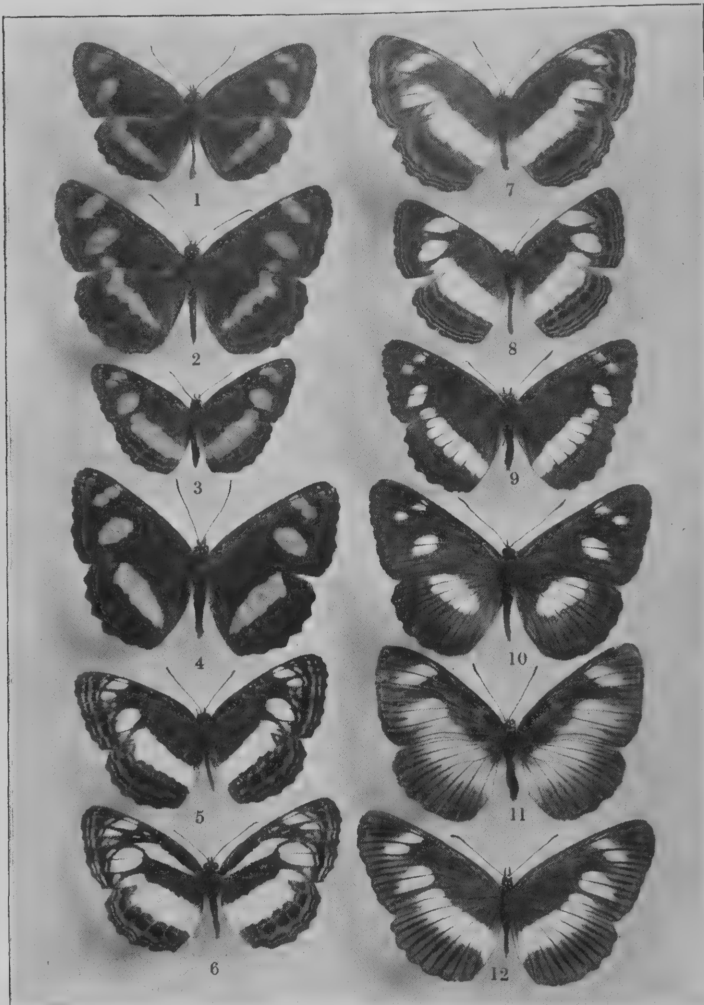
It is in *conspicua* that we begin to get great instability in the form of the male armature. That of the type is asymmetrical, whilst in examples outwardly agreeing more or less closely with the type we find various degrees of shortening and broadening of the claspers with irregular modification of the small projection at the end of that organ. From forms of this pattern we pass to examples in which there is a shortening of the spots in 4, 5, and 6 so that the discal band presents a more evenly curved proximal outline. At the same time the spots become more or less separated by increased blackening of the nervules, the h.-w. discal band is also somewhat narrowed, and we have the form *continuata* of Holland. A slight further reduction of the white markings, especially the spot in f.-w. 2, produces Holland's *metanira*, which seems hardly worth a separate name.

I have before me several examples from the neighbourhood of the Kassai River, the property of my friend Mr. J. J. Joicey. These have an expanse of about 50 mm. Many of them are indistinguishable from forms of *seeldrayersi* except for the absence of white dots in f.-w. cell above, and the streaked instead of spotted pattern in that area beneath. I have figured one on Pl. XXIII, fig. 9.

Other examples from the same neighbourhood are smaller (35–40 mm.), and have all the f.-w. discal spots in 2 and 3 fairly long, rounded at both ends, and about equally separated from each other and from that in 4.

Lastly there is a form from Cameroon, Congo, Uganda, etc., which resembles *conspicua* except that there is a notable interval of the ground-colour between the spot in 3 and that in 4. Pl. XXIII, fig. 10.

I refrain from naming these forms since they are not peculiar to definite localities, whilst numerous intermediates occur in long series. The male armatures are as variable as the patterns, and the whole assembly must for the present be regarded as an unstable species possibly modified by intrageneric mimicry of the kind so elaborately



A. Robinson, Photo. Vaus & Crampton, Ltd.

FORMS OF NEPTIS.

illustrated by the multiple forms of *Heliconius melpomene*. For those who wish to arrange their collections as correctly as possible, I can only suggest that any form which does not present the distinctive characteristics of one of the better-defined species and of which the male armature is variable and not well characterised should be referred to *nysiades*, until longer series from many localities may perhaps enable us to revise these forms in a more systematic manner.

38. Neptis lugubris.

Rebel, Ann. des K. K. Naturhist. Hofmus. Wien., p. 241, pl. 18, f. 4 (1914).

Since the above paper went to press I have discovered the description of this species. It is accompanied by a very poor photograph, from which it is impossible to derive much information as to affinity. It resembles a small example of *agatha* with much reduced white discal bands, and is described as having no white dot in f.-w. cell above or beneath. The state of the f.-w. submarginal lines is not described, but from the photograph they would appear to be continuous. The locality is given as Lake Tanganyika. Only one example was received.

Explanation of Plate XX.

Fig. 1. *Neptis frobenia* Fab. ♂, Mauritius, Coll. Hew. (London).
2. ,, *dumetorum* Boisd. ♀, Reunion (Oxford).
3. ,, *mayottensis* Oberth. ♂, Mayotte I. (Oxford).
4. ,, *comorarum* Oberth. ♀, Grand Comoro (Oxford).
5. ,, *saclava marpessa* Hopff. ♀, Taveta (Oxford).
6. ,, *metella* Doubl. ♀, Lagos (Oxford).
7. ,, *nemetes nemetes* Hew. ♂, Lagos (Oxford).
8. ,, *poultoni* Eltr. ♂ (Type), Chagwe, Uganda (London).
9. ,, *incongrua incongrua* Butl. ♀, Dabida Hills (Oxford).
10. ,, *woodwardi* Sharpe ♀, Kenia (Oxford).
11. ,, *ochracea ochracea* Neave ♀, Chagwe, Uganda (Oxford).
12. ,, *exaleuca exaleuca* Karsch ♂, Bitje, Cameroon (London).

Explanation of Plate XXI.

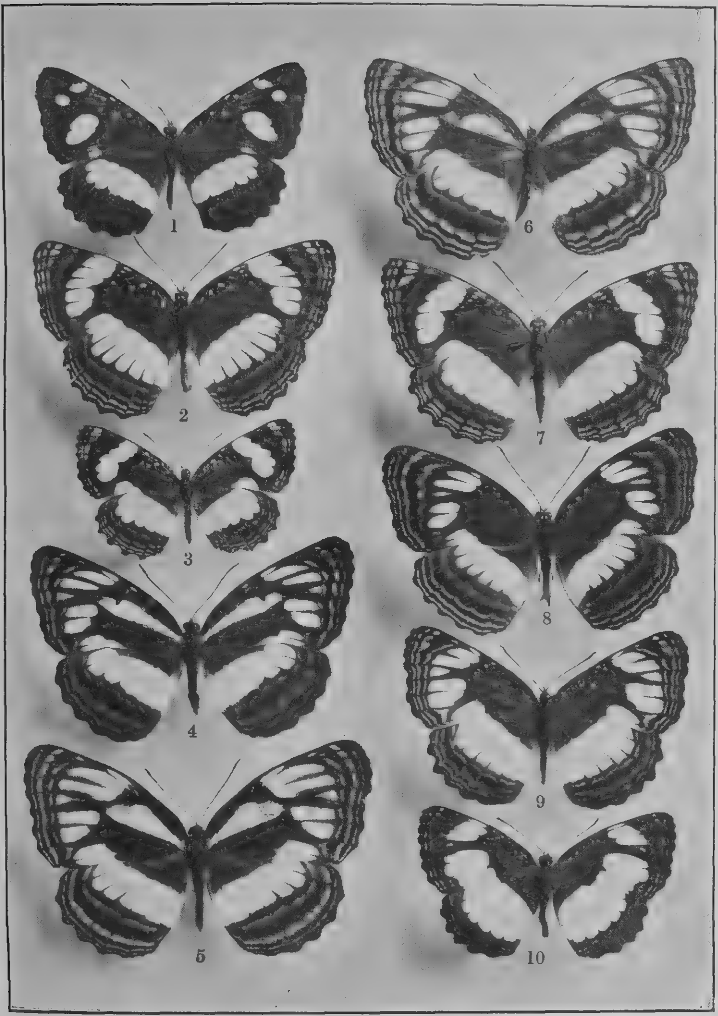
Fig. 1. *Neptis swynnertoni* Trim. ♀, Melsetter (Oxford).
2. ,, *agatha* Stoll ♀, Machakos (Oxford).
3. ,, *jordani* Neave ♀, L. Bangueolo (Oxford).
4. ,, *nebrodes* Hew. ♀, Lagos (Oxford).
5. ,, *jamesoni* Godm. ♀, Lagos (Oxford).
6. ,, *lermanni* Auriv. ♀, Kassai River (Oxford).
7. ,, *seeldrayersi* Auriv. ♀, L. Tanganyika (Oxford).
8. ,, *barnsi* Eltr. ♂ (Type), Belg. Congo (Coll. Joicey).
9. ,, *rogersi* Eltr. ♀ (Type), Mombasa (Oxford).
10. ,, *kikideli* Boisd. ♀, Ambinanindrano (Oxford).

Explanation of Plate XXII.

Fig. 1. *Neptis trigonophora* Butl. ♂, Mombasa (Oxford).
2. ,, *biafra* Ward ♀, Cameroon (Coll. Oberthür). This example agrees very nearly with Ward's original figure.
3. ,, *paula* Staud. ♀, Lagos (Oxford).
4. ,, *rothschildi* Eltr. ♂ (Type), Manyema (Tring).
5. ,, *nicoteles* Hew. ♂, Semliki Valley (Oxford).
6. ,, *nicobule* Holl. ♂, Lagos (Oxford).
7. ,, *mixophyes* Holl. (copied from Holland's figure).
8. ,, *nicomedes nicomedes* Hew. ♂, Entebbe (Oxford).
9. ,, ,, *quintilla* Mab. ♀, Entebbe (Oxford).
10. ,, ,, *puelloides* Eltr. ♂ (Type), Lagos (Oxford).
11. ,, *puella* Auriv. ♀, Entebbe (Oxford).

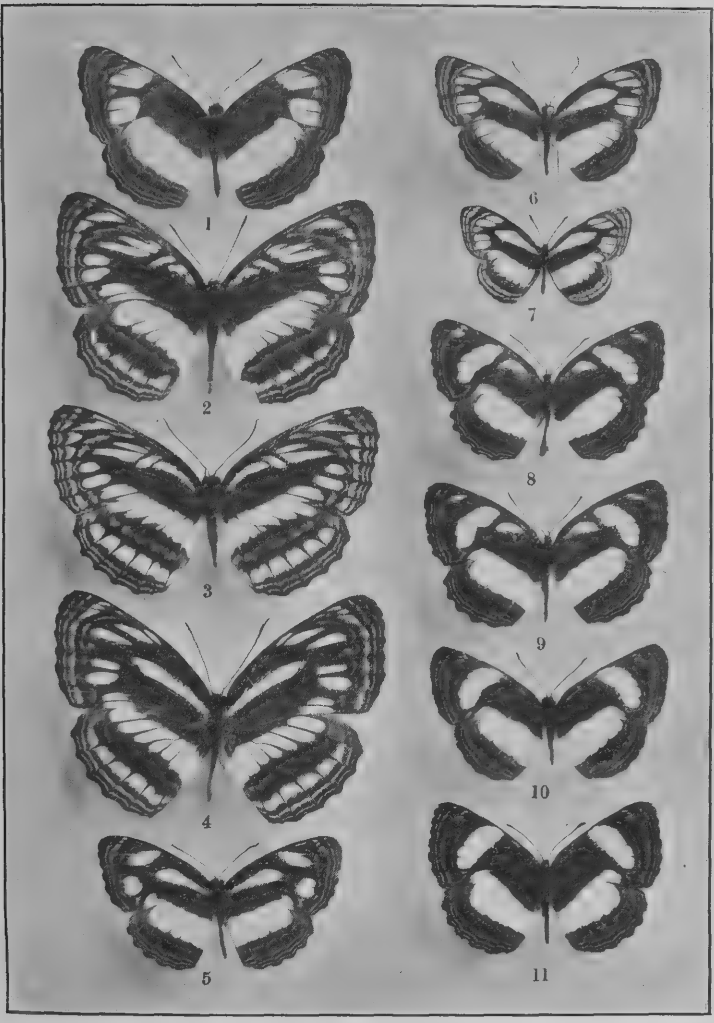
Explanation of Plate XXIII.

Fig. 1. *Neptis melicerta melicerta* Dru. ♂, Unyoro (Oxford).
2. ,, ,, *goochi* Trim. ♂, Durban (Oxford).
3. ,, *strigata* Auriv. ♂, Entebbe (Oxford).
4. ,, *nysiades* Hew. ♂, Bitje (Coll. Joicey). An example very near Hewitson's original figure.
5. ,, ,, ♀, Lagos (Oxford). A form much commoner than the type.
6. ,, ,, f. *clarei* Neave ♂, Entebbe (Oxford).
7. ,, ,, f. *conspicua* Neave ♂, Addah, W. Africa (Coll. Joicey).
8. ,, ,, f. *continuata* Holl. ♂, Cameroon (Coll. Joicey).
9. ,, ,, f. (see p. 586) ♂, Kassai R. (Tring).
10. ,, ,, f. (see p. 586) ♂, Chagwe (Oxford).



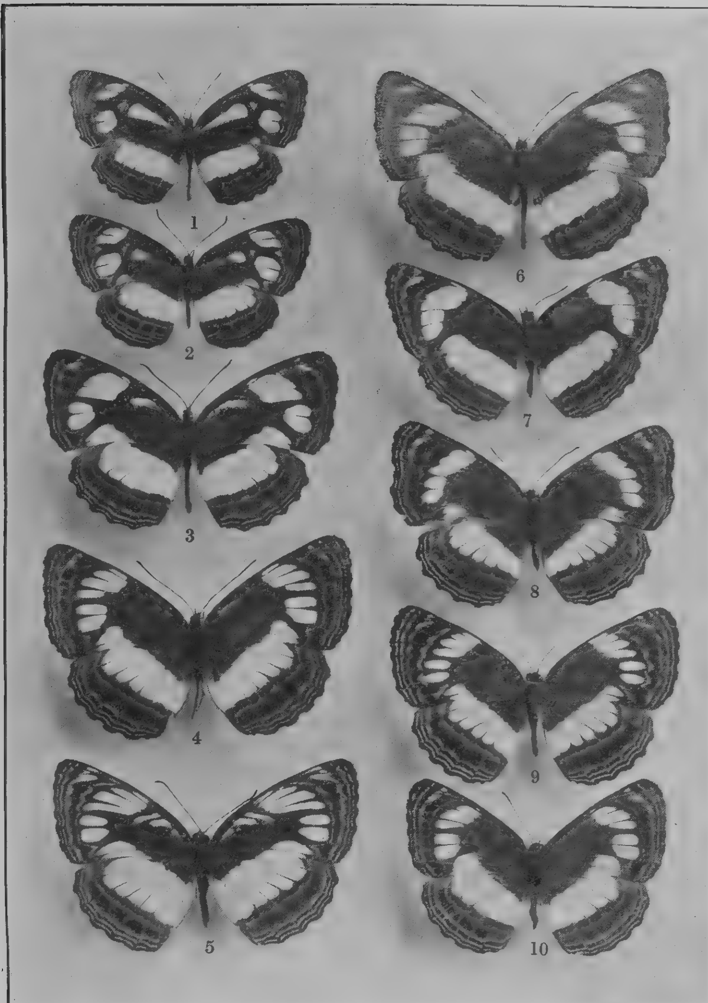
A. Robinson, Photo. *Vaus & Crampton, Ltd.*

FORMS OF NEPTIS.



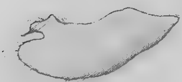
A. Robinson, Photo. *Vaus & Crampton, Ltd.*

FORMS OF NEPTIS.



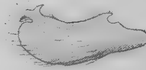
A. Robinson, Photo. *Vaus & Crampton, Ltd.*

FORMS OF NEPTIS.

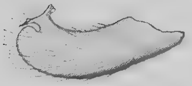


1

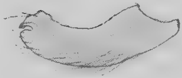
2



3

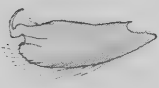


4

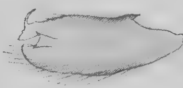


5

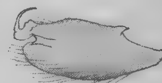
6



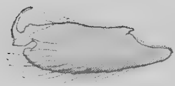
7



8



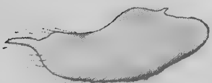
9



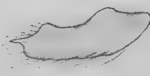
10

11

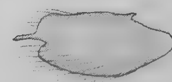
12



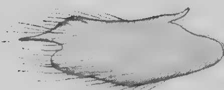
13



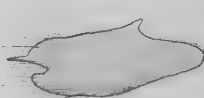
14



15



16

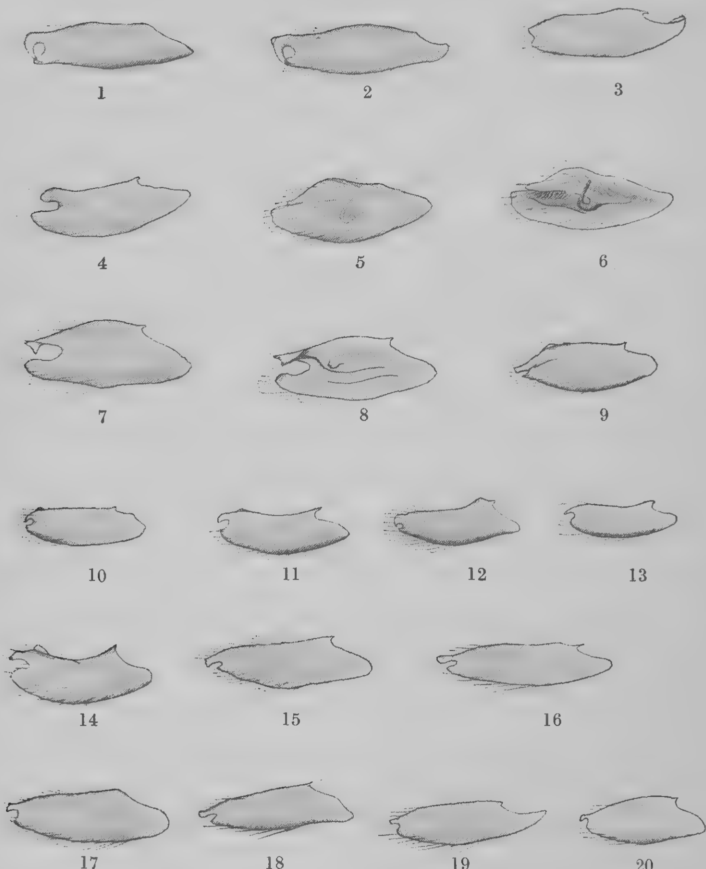


17

18

H. Eltringham, del. *Vaus & Crampton, Ltd.*

GENITAL ARMATURES OF NEPTIS.



H. Eltringham, del. *Vaus & Crampton, Ltd.*

GENITAL ARMATURES OF NEPTIS.

Explanation of Plate XXIV.

Male Claspers of Forms of *Neptis*.

Fig. 1. *frobenia*.
2. *dumetorum*.
3. *mayottensis*.
4. *comorarum*.
5. *saclava*.
6. *metella*.
7. *nemetes* (f. *carpenteri*).
8. *incongrua*.
9. *woodwardi*.
10. *ochracea*.
11. *exaleuca*.
12. *swynnertoni*.
13. *agatha*.
14. *jordani*.
15. *nebrodes*.
16. *jamesoni*.
17. *lermanni*.
18. *barnsi*.

Explanation of Plate XXV.

Male Claspers of Forms of *Neptis*.

Fig. 1. *kikideli*.
2. *trigonophora*.
3. *paula*.
4. *rothschildi*.
5. *seeldrayersi* (external).
6. ,, (internal).
7. *poultoni* (external).
8. ,, (internal).
9. *nicoteles*.
10. *nicobule*.
11. *nicomedes*.
12. *puella*.
13. *nina*.
14. *melicerta*.
15. *strigata*.
16. *nysiades* (nearly typical).
17. ,, (another example of the same).
18. ,, f. *conspicua* (left clasper of the type).
19. ,, ,, (a co-type).
20. ,, f. near *metanira*.

XV. *On new or little-known forms of* Acraea. By H. Eltringham, M.A., F.Z.S.; *with description of a new form of* Acraea encedon, by Prof. E. B. Poulton, F.R.S.

[Read June 4th, 1913.]

Acraea orestia f. *carpenteri.*

= *orestia* f. *humilis*, Eltr., Trans. Ent. Soc., p. 305, 1912 (nec *humilis*, Sharpe).

The description of this form is the same as that given by me (*l. c. sup.*).

I am indebted to my friend Mr. N. D. Riley of the Natural History Museum for calling my attention to the fact that true *A. humilis* differs in certain important respects from the form of *orestia* which so closely resembles it. The acquisition of long series of examples of both these forms from the Mabira Forest, Uganda, has re-established the specific identity of *A. humilis*, and has once more emphasised the difficulty of correctly diagnosing specific distinctions in the absence of ample series of specimens.

The long series referred to above were found by Mr. Riley to consist of individuals which varied from nearly scaleless forms, through a series of intermediates representing the form I have described as *transita* (*l. c.*) up to the usual red hind-winged *orestia*. Further, the nearly scaleless examples are divisible into two groups, one having the sixth and seventh nervures of the hind-wing arising from a common stalk, whilst in the other these nervures arise independently from the cell in the usual manner. I have now examined the genitalia of the form in which the nervures arise from a stalk, and find that their structure differs from that in the unstalked form. It only remained to re-examine the type of *humilis*, when it was found that it exhibited the stalked condition of the nervures. Though described as a female it is actually a male. Both sexes occur in the above series, but there is no marked difference in external characteristics. *Acraea humilis* must therefore be restored to its position as a separate species, and a new name given to the form of *orestia* which so closely resembles it. For this I propose the name *A. orestia* f. *carpenteri*,

since Dr. G. D. H. Carpenter actually showed, by breeding, the specific identity of this form with *A. orestia*. Whether I noticed the stalked condition of the hind-wing nervules when examining the type of *A. humilis* I do not now recall, though if so, I probably attached little importance to it in the absence of a series showing it to be constant, since the feature is quite inconstant in some species of *Acraea*, notably in *A. burni* Butl. On the other hand, it is constant in the very few examples of *A. iturina* which I have been able to examine, and this fact naturally suggests some connection between *humilis* and that species. The genitalia are, however, quite different, so that there is no reason to suppose that they are even allied. It seems scarcely possible at present to decide on the position of this species (*A. humilis*). Most examples have a spot in hind-wing near the base of the cell and sometimes there is a second immediately below this in 1*c*. Beyond these there are no markings, the wings being for the most part transparent with a slight dusting of brownish-black scales about the costa of fore-wing and hind-margin, inner margin and base of hind-wing. The genital armature has a very short uncus somewhat like that in *A. penelope*, whilst the claspers are rather like those of *A. buschbecki*.

The synonymy of the species will now be as follows :—

Acraea humilis, E. M. B. Sharpe, Ann. Nat. Hist., (6) 19, p. 582 (1897); Auriv., Rhop. Aeth., p. 86 (1898); Smith & Kirby, Rhop. Exot., 7, p. 23, pl. 7, f. 3 (*non* f. 1 and 2) (1901).

= *orestia* f. *humilis*, Eltr., Trans. Ent. Soc., p. 305 (1912) (part).

Acraea orestia, Hew., Ent. Mo. Mag., 11, p. 131 (1874); Exot. Butt., *Acraea*, pl. 7, f. 47 (1875); Snellen, Tijdschr. v. Ent., 25, p. 217 (1882); Auriv., Ent. Tidskr, 14, p. 273 (1893); Rhop. Aeth., p. 112 (1898); Lathy, Trans. Ent. Soc., p. 186 (1903); Eltr., Trans. Ent. Soc., p. 305, pl. 15, f. 10 (as *humilis*) (1912).

= *orestina*, Plötz, Stett. Ent. Zeit., 41, p. 190 (1880).
= *iturina*, Neave, Novit. Zool., xi, p. 346 (1904).

f. *transita*, Eltr., Trans. Ent. Soc., p. 306 (1912).

= *humilis* ♂, Smith & Kirby, Rhop. Exot., *Acraea*, 7, p. 23, pl. 7, f. 1, 2 (1901).

f. *carpenteri* nom. nov.

= *orestia* f. *humilis*, Eltr., Trans. Ent. Soc., p. 305 (1912) (part).

Mr. Riley has recently called my attention to several examples of a form of *Acraea doubledayi* which shows marked differences from the typical form of that species.

Acraea doubledayi f. *rileyi*.

♂. Expanse about 52 mm. F.-w. less pointed at apex and less concave along hind-margin than in typical *doubledayi*. Ground-colour pale dusky pink dusted with brown at base, spots smaller and markings generally paler.

H.-w. dull pink with markings as in *doubledayi* but fainter, and hind-marginal border narrower.

Underside resembles that of *doubledayi* but the spots are smaller

♀ resembles ♂.

Toma, Abyssinia. Mus. Brit.

The genitalia of this form are similar to those of typical *A. doubledayi*.

I append herewith Prof. Poulton's description of a new form of *A. encedon*.

A. encedon f. *commixta*, Poulton, f. n.

The pattern of this form is made up of the hind-wing of *alcippina* combined with the fore-wing of *infuscata* in which the subapical bar is not white, but tawny or smoky-brown. The fore-wing thus approaches that of *daira*, but differs in the retention of the black apex.

Commixta occurred several times (although to a variable extent) among Mr. Lamborn's captures and bred families, and its pattern is strongly hereditary. *Commixta* resembles *albinus*, Lanz, itself a rather rare combination of two forms of *Danaida chrysippus*, *alcippus* and *dorippus*. In spite of the resemblance the two forms are not related as mimic and model. It is, in fact, probable that they do not meet. *Albinus* is most often met with in N.E. Africa, while *commixta* has up to the present time been observed only in collections from the West Coast, although there can be little doubt that it exists in Uganda and probably occasionally on the East Coast.

Type in Hope Department, Oxford.

In the Brit. Mus. Coll. there are 2 ♂♂, 2 ♀♀ from S. Leone, 3 ♂♂ from Nigeria, and 1 ♀ from Old Calabar.

I append notes on certain forms of *Acraea* omitted from my monograph, or described since its publication.

Acraea polychroma, Rebel, Ann. d. K. K. Naturhist, Hofmus, Wien, p. 410, pl. 14, f. 3 (1910).

There seems nothing in the figure or description of this form to distinguish it from *A. amicitiae*, Heron. The locality is, however, different, viz. N.W. shore of L. Tanganyika, 2,000 m.

We must, I think, regard *polychroma* as a synonym of *amicitiae*.

A. pullula, Grünberg, Deut. Zent. Af. Exp., p. 516, pl. 11, f. 7 (1911).

As the publication referred to is difficult to obtain, I give herewith a translation of Grünberg's description.

Allied to *A. vinidia*, Hew. Colouring as in var. *tenella*, Rogenh. The yellow markings of less extent, the wings shorter and more broadly rounded.

♂. Upperside, ground-colour blackish-brown, distal half of fore-wing uniformly dark, without pale subapical band. Inner marginal spot of fore-wing on middle of margin 5.5 mm. in width, of the same width in area 1*b*, extending over the basal part of area 2, obscured in the cell and barely indicated in the angle of area 3.

H.-w. very like that of *vinidia* var. *tenella*, the yellow basal part somewhat less developed, the blackish-brown border broader, with small, barely indicated reddish-yellow marginal spots. The black basal spots not perceptible on the upperside. Underside more heavily and extensively darkened than in *vinidia*. Both wings with acute angled yellow marginal spots, subapical band in fore-wing merely vestigial, hind-marginal patch much as on upperside. The pale basal area of h.-w. very much reduced by the black markings, the black basal spots of the costa and cell fused together, beyond the cell large and very black, the distal ones extended into long streaks. The yellowish-red markings distinct only in area 1*c*. On the costa before the precostal nervure a well-defined yellowish-red spot.

Expanse 33 mm.

Ruanda, Mohasi Lake, vii. '07. 1 ♂.

The figure accompanying the description is a very poor one, but I should be much surprised if this form is not ultimately found to be a mere aberration of *A. acerata*.

The fusion of black spots into streaks is an almost certain characteristic of aberration, added to which we have the well-known extreme variability of *A. acerata*.

Acraea (*acerata*) *vinidia*, f. *ruandae*, Grünberg, *l. c.*, p. 516, pl. 11, f. 6 (1911).

This form is described as bearing the same relation to f. *diavina* as does f. *tenella* to the type. The description is as follows :—

Upperside very like that of *tenella*. Pale markings straw-yellow with faint reddish-yellow suffusion. H.-w. with small indistinct yellow marginal spots. Subapical band of f.-w. as large as in *tenella*, the pale mark before the end of cell separated from inner marginal spot. Discal spot in area 1*b* and 2 large and well defined, but somewhat smaller than in *diavina*. Underside also very like that of *tenella*. Discal spot of 1*b* and 2 smaller than above. Black basal and discal spots of h.-w. small, the red streaks scarcely indicated. Length of f.-w. 19 mm.

Ruanda, Mohasi Lake, vii. '07 1 ♀.

A. tropicalis, Blachier, Bull. Soc. Lep. Genève, p. 174, pl. 15, f. 2 (1912).

Ngomo, Fr. Congo.

This is a form of *A. pelopeia* having somewhat less than the normal suffusion on the nervules on the underside of hind-wing.

A. conradti ab. *flavescens*, Blachier, *l. c.*, p 175, pl. 15, f. 3 (1912).

German E. Africa.

The usual red ground-colour is replaced by pale ochreous.

A. horta ab. *conjuncta*, Blachier, *l. c.*, p. 176, pl. 15, f. 4 (1912).

Ground-colour dull brownish-yellow. Hind-wing markings elongated and confluent. No locality.

A. eugenia f. *ochreata*, Grünberg, S. Ges. Nat. Fr. Berlin, p. 470 (1910).

Described as differing from typical *eugenia* in being more densely scaled. The fore-wing with a distinct black

discocellular spot. Hind-wing from base to middle scaled with yellowish-brown.

Spanish Guinea, Makomo, Ntume Region. 1 ♂.

Acraea egina ♀ f. *alba*, f. nov.

Grünberg has already * remarked on the ♀♀ of *A. egina* from Sesse I. Examples received at Oxford from Dr. Carpenter exhibit the same peculiarities, and it seems desirable that the form should have a name. On the upperside there is no trace of red or ochreous. The ground-colour is dark sepia grey to black. There is a white subapical bar in fore-wing and the outer half of cell, the space just beyond end of cell, base of area 2, and central part of area 1*b* are dusky white. In the hind-wing the internervular spaces and often the central part of cell are also powdered with dusky white. On the underside there is no red except in area 9, base of 7, base of cell, and of areas 1*c*, 1*b* and 1*a*.

There are in the Oxford collection one or two very similar examples from near Mombasa, but these are associated with ♂♂ of the *areca* form, whereas the ♂ *egina* in Sesse I. is of the typical or western pattern.

The close resemblance of this form to the rare western form *medea* is very remarkable.

Sesse I. Type, Oxford.

Acraea terpsichore f. *ventura*, Hew. (note).

Grünberg has also noted (*l. c.*) that examples of *A. terpsichore* from Sesse I. have the red patches on the hind-wing underside exceptionally well marked. Dr. Carpenter's specimens also show this feature, and all belong to the *ventura* form though differing in the fact that the subapical patch of ground-colour in fore-wing is rarely completely cut off by the discal black bar. The brilliance of the red on the hind-wing underside is in most examples very noticeable, and the inner edge of the marginal border is also frequently dusted with red. The form is scarcely sufficiently well defined to require a name.

One ♂ example differs from all the others in having the marginal and subapical black of the fore-wing and the marginal black of the hind-wing considerably extended, so that the spots of ground-colour are much reduced and

* Sitzb. d. Ges. Naturf. Fr., (4) p. 148, 1910.

the fore-wing subapical patch is very small. In this example the underside of hind-wing has the basal portion dull red, the discal area dusted with red and the inner edge of the hind-marginal border of the same colour. The hind-marginal border is without the characteristic black internervular triangular markings.

A. egina, ab. *contraria*, Grünberg, Soc. Ent. Steglitz, p. 145 (1910).

Described by Grünberg from three male examples from Lake Kiwu.

The form resembles *A. egina* f. *harrisoni*, Sharpe, but the black spots of the hind-wing are much smaller, and on the hind-wing underside the hind-marginal black is much reduced.

A similar example occurs in the Oxford collection and was taken by Neave on Chirui Island, L. Bangweolo.

XI. *On Certain Forms of the Genus* Acraea. *A reply to M. Ch. Oberthür.* By H. Eltringham, M.A., D.Sc., F.Z.S.

[Read June 7th, 1916.]

Plate LXXIV.

In M. Charles Oberthür's Études de Lépidoptérologie Comparée," Fasc. xi, 1916, appears a study of Madagascan Lepidoptera, largely dealing with species of the genus *Acraea.* M. Oberthür states that after reading with great pleasure my monograph of the African species of the genus *Acraea* he has been moved to endeavour to complete some of the details and dispute some of my conclusions.

I would say at the outset that any criticism of my work is welcomed by no one more than by myself. M. Oberthür (p. 133, l.c.) says, " Un même sentiment nous anime, M. le Professeur Houlbert et moi même; la recherche de la vérité." All true scientific workers are animated by this sentiment, and if I feel it necessary to criticise to some extent Professor Houlbert's conclusions, he will, I am sure, consider my remarks in the same friendly spirit in which they are made, and as our countries are allied in the suppression of a barbarous race, so, in a more peaceful sphere, our scientists are allied in the search after truth.

First, then, as to the structure of the male armature in *Acraea*, Professor Houlbert suggests that in this genus occur the most complicated organs to be found in the Lepidoptera. The point is not of great importance, but I would ask him to examine, merely as a relaxation, the armatures of, say, *Hypolimnas monteironis*, some of the *Lycaenidae*, and Plate I in " The Genitalia of the *Noctuidae*" (F. N. Pierce, Liverpool, 1909).

Professor Houlbert next questions my contention that Mabille's effort to classify the genus *Acraea* on the structure of the armature is of little value. I stated at the time that Mabille's view seemed " based on an inadequate study of these structures." I see no reason to modify that statement now, and would only add that had Professor Houlbert

made some five hundred carefully mounted preparations of *Acraea* genitalia, as I had to do for my monograph of the genus, he would, I am sure, agree entirely with my statement.

At this point Professor Houlbert makes a curious error in quoting my words. In referring to Schatz and Röber's efforts to classify the species of *Acraea*, I stated that the "characters given are for the most part inconstant." These words Professor Houlbert makes to be my criticism of Mabille instead of Schatz and Röber. It is true I said almost the same thing of Mabille's characters. The words are: "the impossibility of these groups is evident from the instability of the characters suggested." My meaning here was, however, slightly different. Mabille named one of his groups *Aphanopeltis*, and his characteristic for this group was that the ventral plate of the male armature was a structure of variable form. It did not seem to me that variability, or as I said, instability, could be regarded as a suitable characteristic on which to found a subgenus. Moreover, the features Mabille selected for his classification are not features of a comparable kind, since in some species they do not occur at all. Finally, his attempt suffers from the great objection that it utilises a purely sexual characteristic as a feature on which to base a classification.

Now, whether applying to Mabille or to Schatz and Röber, Professor Houlbert objects to my words "the characters given are for the most part inconstant," and says, "mais, ou trouve-t-on des charactères constants?" Naturally I agree with him that characters are not constant in the absolute sense of the word. Were they so the whole majestic scheme of evolution would be an impossibility. Nevertheless, there are characters which are relatively sufficiently constant to enable us to use them as a basis for classification, and when I spoke of the inconstancy of Schatz and Röber's characters I indicated that they were devoid even of that relative constancy which was necessary if they were to be of any taxonomic value. I have nothing but admiration for the descriptions and excellent drawings of the armatures of *A. igati* and *A. damii.* As a study in the anatomy of these insects they are admirable. In a footnote on p. 145 Professor Houlbert says, "Mr. H. Eltringham, l.c. p. 7, a donné de ces organes, deux petites schémas trop simplifiés (fig. 11 et 12) qui ne peuvent fournir

qu'une idée très imparfaite de l'armature génitale des *Acraea*." I agree entirely that my "two little diagrams" "can only furnish a very imperfect idea of the genital armature in *Acraea*." They were not made with any such comprehensive purpose in view, but merely to illustrate the most essential differences between the two species *igati* and *damii*. My monograph runs to some 375 pages and over 250 illustrations. To have dealt with the detailed structure of the armatures of the 140 species of *Acraea* would have required another volume of similar dimensions, and would scarcely have served an advantageous purpose.

The second part of Professor Houlbert's interesting contribution deals with the sphragis, or seal, found on the female of most species of *Acraea* after pairing. That this structure is of great interest, and its function somewhat obscure, I certainly agree, but I cannot think that Professor Houlbert has thrown much light on the subject by declaring, as he does, that the sphragis is not the result of a secretion deposited by the male on the abdomen of the female. It is true that the process of formation has not, so far as I am aware, been actually observed in the case of an *Acraea*. A homologous formation occurs, however, in at least seven other genera of butterflies, and in the case of *Parnassius* the process of formation has been investigated by Mr. Arthur Thomson, and the subject is dealt with at some length by Mr. H. J. Elwes in his paper on *Parnassius* in Proc. Zool. Soc. Lond., p. 6 *et seq.*, 1886. In my monograph I referred to this article, but did not give extracts from it, thinking that the investigations mentioned were sufficiently well known. I would refer Professor Houlbert, and others who may be interested, to this paper. He will there see that the "pouch" is produced during copulation, and that there is exuded from the abdomen of the male a gelatinous substance which hardens rapidly on exposure to the air, and retains in its hardened condition impressions made upon it whilst in the viscous state. The sphragis in *Acraea* being a formation homologous with that in *Parnassius*, there is every reason to suppose that its origin is of the same nature. On p. 8 of my monograph I pointed out that Marshall had observed no less than three female Acraeas in which the sphragis had been duplicated, though both formations were more or less distorted in shape, "indicating that the second pairing must have

taken place immediately after the first, and whilst the first secretion was in a more or less viscous condition." That it is only produced by pairing is certain, since bred females, of which we have hundreds of examples at Oxford, *never* show the structure in question. In face of this fact it is difficult to understand why Professor Houlbert should have written, "Quant à l'origine même du sphragis nous n'avons pas en ce moment, de données assez précises; mais nous ne désespérons pas de l'expliquer le jour òu il nous sera permis de suivre l'évolution de quelques Acraea vivants. Dans tous les cas, nous ne pouvons pas accepter l'opinion des auteurs qui considèrent le sphragis comme le résultat d'une secrétion déposée par le mâle sur l'abdomen de la femelle au moment de l'accouplement."

Professor Houlbert expresses the opinion that the sphragis, owing to its perfect adaptation to the shape of the male armature, ensures the precise and unerring action of those complicated organs. It seems not to have occurred to him that the exact correspondence in shape between the sphragis and the male armature is due to the same cause which governs the correspondence between the plaster cast and its mould: the one has taken its shape through intimate contact with the other.

Two further points remain. Professor Houlbert on p. 152 expresses the opinion that the sphragis is an organ of adaptation, and that after pairing it falls off, and the female genital plate being thus uncovered, the eggs can be deposited, without hindrance, on the plants which are to sustain the larvae.

Now, in the first place, the sphragis does not fall off under normal conditions. It is found on the parent Acraeas in the Hope collections at Oxford, from which were bred long series of examples. Secondly, there is no necessity for its removal, since the external opening of the oviduct is not the same as the copulatory opening, but occupies a posterior position. The insect would be in no way inconvenienced in the matter if the copulatory orifice were hermetically sealed for the rest of its life after pairing. This fact of butterfly anatomy has doubtless escaped Professor Houlbert's notice. The remaining point with which I must deal is the statement on p. 158 that the uncus of the male is more highly developed in those species whose females are found to bear a sphragis, and is very small in cases where the genital plate is reduced or absent. In very

many of the smaller Acraeas the sphragis is not or scarcely at all developed, yet in these the uncus is, in proportion to the claspers, very large and well developed.

In one or two places Professor Houlbert suggests that he has had some difficulty in making out the structure of the genital armatures owing to their desiccated condition. Should he continue his investigations, and I sincerely hope he will do so, he will find that if the terminal segments of the abdomen are boiled in caustic potash (KHO) for a minute or two all extraneous matter is easily removed, and the specimen can be dehydrated, cleared in clove oil, and mounted in Canada balsam in a cell so that it is not compressed. He will then find that the organ can be examined under the most favourable conditions, and its form easily made out with the help of the stereoscopic microscope.

If he will submit a sphragis to the same treatment he will find that it disintegrates and dissolves with great rapidity, conclusive evidence that it is of an entirely different chemical constitution from that of the organs to which he would seek to ally it.

Following on this discussion of the armature and sphragis generally, M. Oberthür contributes interesting details concerning some of the less-known Madagascar Acraeas. He points out an error in my account of *Acraea igati*, which I stated to occur only in Madagascar, whereas he has examples from Anjouan and Grand Comoro. I was, of course, unaware of this when my paper was published. *A. damii* and *A. fornax* are dealt with, and finally the author gives a comparative study of *A. strattipocles*, *A. masamba*, and a form to which he gives specific rank, *A. siliana*. M. Oberthür's discussion of these forms is a most useful addition to our knowledge. With characteristic generosity the eminent French naturalist has presented to the Hope Collection at Oxford beautiful series of several Madagascar species of *Acraea*. Amongst these are a number of examples labelled *masamba* and some labelled *silia*. M. Oberthür now finds that the latter do not in reality correspond to Mabille's var. *silia*, but are in fact an undescribed form which he regards as a good species, and for which he proposes the name *siliana*. Furthermore, he declares his inability to distinguish the species of *Acraea* to which Mabille's Pl. 9, fig. 1, 1*a* (*masamba*) and fig. 3 (var. *silia*) belong. *A. strattipocles* is dealt with in the same section of the paper, but as there is no difficulty in identifying

this as a good species, it remains only to deal with *masamba* and *siliana*.

M. Oberthür expresses his regret at having sent specimens labelled as *silia*, which do not precisely agree with Mabille's *silia*, and which he now refers to his new species *siliana*. Professor Houlbert has examined the male and female genitalia and also some of the wing scales, and the specific rank of *siliana* is claimed on the following points.

	masaba	*siliana*
H.-w. border upperside	regular outline	indented at 4th nervure.
F.-w. inner margin	suffused with black	not so.
Papilla on which occurs external orifice of bursa copulatrix	rounded	triangular.
Uncus of male	straight	curved.
Scales from f.-w. apical area	suboval	subtriangular.
Ditto from internal angle	rounded	subangulate.

Now, in dealing with these points I should explain that in discussing the forms in my monograph, the supposed examples of *silia* which I had before me were specimens of what M. Oberthür now calls *siliana*, and furthermore amongst those labelled *masamba* were four examples of the *siliana* form, but of the dark ground-colour similar to that in *masamba*, a variety named by M. Oberthür *A. siliana antakara*. It was on these examples that, in speaking of the indentation of the hind-wing border, I based my remark that "the same feature is observable in varying degrees of development in a series of *masamba*." * Having removed these examples, I must admit that the indentation of the border is peculiar to the *siliana* form. Moreover, the black suffusion of the inner margin of the fore-wing in *masamba*, especially in the male, seems a good character. As to the papilla related to the orifice of the *bursa copulatrix* in the respective females, I regret I have not been able to make out this character, alluded to by Professor Houlbert,

* This remark of mine is curiously misquoted on p. 170, the word "observable" being printed "*in*observable" and emphasised by small capitals.

though it may well be as he states. Greater differences than this occur in the genital plates of forms of *A. acrita*, but do not enable us to define specific limits to those forms. The alleged difference in the uncus in the two species does not appear to me to be valid. The organ in both species is curved in a vertical plane. If Professor Houlbert alludes, as I think he does, to a curve in the horizontal plane, such an appearance in a dry specimen is of no value whatever, since the organ is frequently distorted through desiccation. In the many dissections I have made, I have never found the uncus in any *Acraea* to be curved laterally when once its flexibility has been restored by the caustic treatment. Such a curved condition would be a form of asymmetry, a phenomenon which, so far as my experience goes, does not occur in any species in the male, though one or two females have an asymmetrically placed copulatory orifice (*neobule*, etc.). In my opinion, the male armatures of *masamba* and *siliana* are not distinguishable when the features of these organs are considered as a whole and in relation to those of other species of the genus. In some genera the male armatures are practically indistinguishable, and so useless for specific distinction, but the genus *Acraea* is remarkable for the constant intra-specific differences in the genitalia.

Now as to the scales. On Plate LXXIV I have illustrated sixteen examples of scales in an endeavour to confirm Professor Houlbert's conclusions. Figs. 1–5 are taken from the fore-wing apical area of *A. masamba*, and figs. 6–10 from the same area in *A. siliana*. No two are exactly alike, nor do any quite resemble Professor Houlbert's figures on p. 169 of the paper referred to. In spite of diligent search I could find no scales which had not the deeply indented "shoulder" at the base, shown in my drawings, but quite absent in those of Professor Houlbert. Figs. 11–13 are from the fore-wing internal angle of *masamba*, and figs. 14–16 from the same area in *siliana*. So far as I can judge, the outlines of the scales are so variable that they do not furnish a character which is useful in this case for specific distinction. Nor is the outline of scales an entirely satisfactory character for the purpose, since my friend Dr. F. A. Dixey has found that even the Pierine scent scales, so characteristic in most cases, show considerable variation in different individuals of *G. napi*.

Let us then sum up the whole matter : The most essential

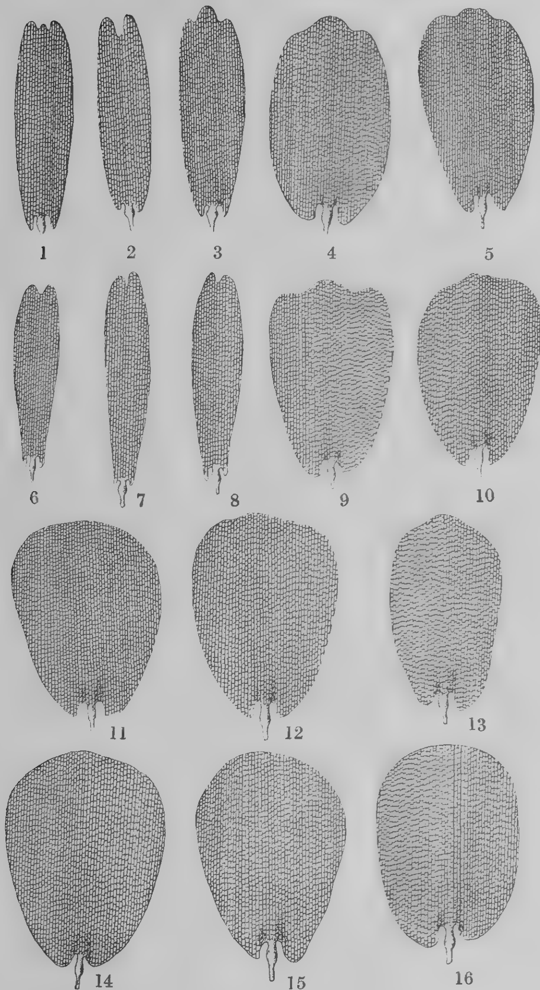
and constant differences between the two forms are differences of pattern. The structural differences are very slight and open to question. In my monograph of the genus I stated that "with our present conception of the evolutionary nature of species formation the precise limitation of what is called a 'species' has necessarily lost much of its importance, as compared with the recognition of the degrees of affinity which appear to obtain between the forms studied. . . . In many cases it is extremely difficult, if not impossible, to decide whether a form has yet passed over that dividing line which separates one true species from another. The difficulty experienced is merely a confirmation of our theories of species formation." *A. siliana* does not appear to occur in precisely the same localities as *A. masamba*. The characteristics of *A. siliana* as compared with *A. masamba* are equivalent to those I should regard as applying to a subspecies, *i.e.* a geographical race not entirely and specifically separate. M. Oberthür prefers to regard the two forms as distinct species. After all, it is of little real importance which view we adopt. The case is similar to that of *A. welwitschii* and *A. anemosa*.

Finally, I should wish to express my appreciation of M. Oberthür's most valuable and interesting contribution to our knowledge of the Acraeas, of M. Culot's exquisite plates, and of Professor Houlbert's beautiful drawings. The structural features of the Lepidoptera have too long been obscured by the dazzling beauty of their wings, and we shall look forward with pleasurable anticipation to further valuable communications from so ideal a collaboration as that of M. Charles Oberthür and Professor Houlbert.

Explanation of Plate LXXIV.

Figs.	1–5.	Scales from f.-w. apical area of	*A. masamba.*
	6–10.	„ „ „ „ „	*A. siliana.*
	11–13.	„ „ „ internal angle of	*A. masamba.*
	14–16.	„ „ „ „ „	*A. siliana.*

December 29, 1916.



H. Eltringham, del.

André, Sleigh & Anglo, Ltd.

SCALES OF ACRAEA.

XI. *On the Species of the Genus* Larinopoda *Butler.* By H. Eltringham, M.A., D.Sc., F.Z.S.

Plates X, XI.

[Read May 3rd, 1922.]

The genus *Larinopoda* was founded by Butler in 1871 (Trans. Ent. Soc. p. 172, 1871). Doubtless at that time the classification of the Rhopalocera on the structure of the feet was not generally understood. In any case, Butler seems to have had some difficulty in placing the genus, and states that though "evidently belonging to the Pierinae" it seems to be intermediate between *Eronia* and *Deloneura*. He states that its "natural position in the Pierinae is between *Nepheronia* and *Euchloe*."

His description of the genus is as follows:—

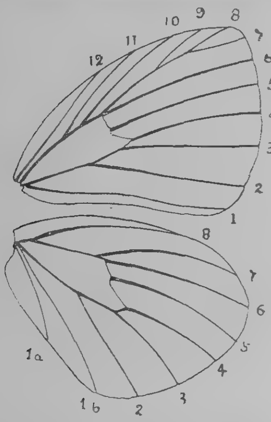
"Wings pyriform; front wings with five subcostal branches, the first emitted at a short distance before the end of the cell, the second immediately before the end, the third half-way between the cell and apex; the fourth and fifth at two-thirds the distance from the cell to the apex; upper discocellular short, slanting obliquely inwards; lower three times the length of upper, angulated, slanting obliquely outwards; median branches emitted near together; hind-wings with subcostals emitted close together, so as to reduce the upper discocellular to a point; lower discocellular very oblique, about eight times the length of the upper; second and third median branches emitted at about half the distance from each other that exists between the second and first; body short, robust; abdomen swollen beneath; legs thick, antennae short, slender, feebly clubbed; palpi long, slender, not hairy."

The type of the genus is given as *Larinopoda lycaenoides*, but the same insect had been described by Hewitson five years previously as *Liptena lircaea*. It is rather remarkable that Hewitson recognised this species as a Lycaenid and in the same year not only placed the species now known as *Citrinophila erastus* amongst the Pierinae, but exhibited considerable annoyance when its real affinity was pointed out by the late Roland Trimen. (See Proc. Roy. Soc. B. vol. 91, 1920, pp. xxiv, xxv.)

Smith and Kirby mention the genus again in 1887 (Rhop. Exot. Lycaen. vol. 1, Oct. 1887), referring it to the Lycae-

nidae, but they immediately proceed to include in the genus species of *Pentila* and *Liptena*, the neuration of which does not agree with that of *Larinopoda*. The neuration is correctly illustrated by Röber (Staud. & Schatz, Exot. Schmett, pl. 50, 1892) and also in the accompanying text figure.

Larinopoda belongs to that section of the Lycaeninae in which there is no precostal nervure in the hind-wing, a character which distinguishes it from *Alaena*, *Pentila*, and *D'urbania*. Nervures 6 and 7 in the h.-w. do not arise from a common stalk, thus distinguishing the genus from



Mimacraea, *Pseuderesia*, *Citrinophila*, *Eresina*, and *Argyrocheila*.

Its further characters as given by Aurivillius (Rhop. Aeth, p. 253, 1898) are as follows :—

F.-w. nervure 6 arises from the end of cell, the f.-w. has 12 nervules, the inner margin of the h.-w. is straight or slightly convex. The cell of both wings is posteriorly sharply edentate so that the posterior angle is projecting, especially in h.-w. The lower discocellular of the h.-w. is very long, straight or somewhat bent outwards. Nervures 3 and 4 of the h.-w. always widely separated at origin. The two antepenultimate abdominal segments in the female hemi-spherically swollen.

At present the genus is known to contain only a few species of small white or cream-coloured butterflies with

shaded or black markings. They are all found in the Ethiopian Region and are principally of W. African origin. Specific diagnosis on the somewhat feeble external characters is unsatisfactory, and I have therefore endeavoured to rearrange the known forms in accordance with the structure of the male armature.

This organ is of a rather complicated type. To give illustrations of the whole apparatus in each case would be misleading, since the slightest difference in the point of view would suggest differences of structure not really existing. Indeed, a considerable experience of these organs in different genera convinces me that the person actually making the preparations is probably the best qualified to judge of differences and resemblances.

Careful dissection under the stereoscopic microscope gives a general impression of structure, and above all of relative position. The ultimate preparations should be mounted in cells so that they are not distorted by pressure, and for purposes of illustration good drawings are always preferable to photographs, since the latter convey little or no impression of relative position. At Pl. X, fig. 2, I have drawn the entire apparatus taken from a form of *Larinopoda aspidos* f. *brenda.* There are two claspers the distal ends of which are characteristically lobed, the uncus is blunt and bifid, and below it there are two hooks more clearly shown in fig. 3, which is a posterior view of this part in *L. tera.* Each clasper, near the proximal end and on its lower side, has a small chitinous projection which appears to be attached by strands of rather tough connective tissue to a ventral projection on the aedeagus. The latter is a rather unusually shaped organ, the duct enters it more or less in the middle, and the part more proximally situated is apparently in the form of a lever.

The uncus and claspers are connected by webs of tough membrane not shown in the figure.

After some experiment I have decided that the best type of illustration for exhibiting the specific differences between the armatures in this genus is a dorsal view of the two claspers placed as nearly as possible in their natural position. For this purpose the rest of the armature is cut away and the claspers left with their natural membranous connection and mounted in that position in a cell. The remaining illustrations are all drawings of the claspers taken from this point of view.

On the posterior end of the thorax just above the attachment of the abdomen there appears to be a membrane divided into two nearly circular tympana. Whether this is merely the structure of that part of the thorax or is an organ comparable to the thoracic tympanum in Geometridae, Uranidae and other moths, I am unable to decide until I can obtain material in a proper condition for dissection.

KEY TO SPECIES AND FORMS OF *LARINOPODA*.

H.-w. beneath with a spot in cell.	(*a*).
H.-w. beneath without a spot in cell.	(*b*).
(*a*) H.-w. beneath with delicate undulating shading.	*tera.*
H.-w. beneath without delicate undulating shading	*eurema.*
(*b*) H.-w. beneath with dark border, broad and even or broken into more or less triangular spots, or even merely suffused.	(*c*).
H.-w. beneath without dark border.	(*g*).
(*c*) Ground-colour cream white, h.-w. border broken into triangular spots.	(*d*).
Ground-colour chalk white, h.-w. border not broken into triangular spots.	(*e*).
(*d*) H.-w. beneath with submarginal spots.	*lircaea* f. *spuma.*
H.-w. beneath without submarginal spots.	*lircaea* f. *hermansi.*
(*e*) H.-w. beneath with submarginal spots.	*aspidos* f. *brenda* (*part*).
H.-w. beneath without submarginal spots.	(*f*).
(*f*) H.-w. above with broad dark border.	*aspidos aspidos*, ♂.
H.-w. above without broad dark border.	*aspidos aspidos*, ♀.
(*g*) Ground-colour creamy white . .	*lircea.*
Ground-colour chalky white.	(*h*).
(*h*) H.-w. with submarginal spots.	(*i*).
H.-w. without submarginal spots.	*lagyra.**

* Occasional examples of *aspidos* female have hardly any brownish scaling beneath and are very difficult to distinguish from *lagyra*. Generally, however, at least a few such scales can be distinguished.

(*i*). H.-w. beneath with brownish dusting at inner angle . . . . *aspidos* f. *brenda* (*part*).
H.-w. beneath without brownish dusting at inner angle. . . . *lagyra* f. *punctata*.

LARINOPODA LIRCAEA. Pl. X, fig. 1, Pl. XI, fig. 6.

Hew., Exot Butt. (*Pentila and Liptena*), pl. 1, f. 10, 11 (1866); Staud., Exot. Schmett., 1, p. 268, pl. 94 (1888); Smith and Kirby, Rhop. Exot., 24, Lyc. Afr., p. 95, pl. 21, f. 10 (1893); Auriv., Ent. Tidskr., 16, p. 199 (1895); Rhop. Aeth., p. 272 (1898); Strand, Archiv. f. Natursgesch. Abt., 12, p. 133 (1913); Auriv., in Seitz, Macrolep., p. 329, pl. 63*d* (1914–18).

= *lycaenoides*. Butl., Trans. Ent. Soc. Lond., p. 173, pl. 7, f. 2–5 (1871).

NIGERIA. GABOON. CAMEROON. CONGO. ANGOLA. BAHR-EL-GHAZAL.

lircaea ab. *alaenica*. Strand, Archiv. f. Natursgesch. Abt. A, 12, p. 133 (1913).
SPANISH GUINEA (Alen Benito).

lircaea ab. *alenicola*. Strand, *l.c.*
SPANISH GUINEA (Makomo Campo).

lircaea ab. *benitonis*. Strand, *l.c.* p. 134.
(Alen Benito).

lircaea ab. *makomensis*. Strand, *l.c.*
(Makomo Campo).

lircaea ab. *simekoa*, Strand, *l.c.*
CAMEROON (Simekoa).

lircaea ab. *bibundica*. Strand, *l.c.*
CAMEROON (Bibundi).

lircaea f. *hermansi*, Auriv., Öfvers. Vet. Akad. Förhl., 53, p. 435 (1896); Rhop. Aeth., p. 273 (1898); in Seitz, Macrolep., p. 329 (1914–18). Pl. X, fig. 2 (*prox.*).
CONGO (Uhangi R.).

lircaea f. *spuma*, Druce, Proc. Zool. Soc. Lond., p. 361 (1910); Auriv., in Seitz, Macrolep., p. 329, pl. 63f. (1914–18). Pl. X, fig. 3.
CAMEROON (Bitje, Ja River).

lircaea f. *innocentia*. Gaede, Int. Ent. Zeit. Guben, 9 Jahrg., No. 21, p. 111 (1916) (as *Larynopoda*).
CAMEROON (Dengdeng).

lircaea lircaea.

Exp. 40–50 mm. Sexes not specially differentiated in pattern. Ground-colour creamy white. F.-w. costa slightly blackened at

base, the dark scales reduced to a very fine line a little beyond middle. Apex with sepia scaling forming a border about 1·5 to 2 mm. wide at apex, with a tendency to invasion of the ground-colour on nervule ends. This apical darkening extends as far as nervule 3. H.-w. all cream white.

Underside. F.-w. much as above but apical dark colour reduced to faint subtriangular marginal marks or even to a fine marginal line. On costa, just above cell end, a well-defined subtriangular, almost black mark, its base on costa. H.-w. with a rounded sepia black submarginal spot in 6, and a small similar spot in 1*c* opposite origin of nervule 2.

There is a certain amount of variability in more or less typical forms of this species, especially in the extent of the f.-w. apical blackening. The costal black varies in width and is sometimes rather sharply cut off opposite cell end. It can be distinguished from other species except *tera* by its cream-white ground-colour, and *tera* has a spot in h.-w. cell beneath. Strand has described and named several variations. Whether they all really belong to the present species it would be impossible to say without examination, but as the descriptions are published I give a short account of them here.

lircaea ab. **alenica.**

F.-w. apical black 3 mm. wide at apex and reaches beyond nervule 2.

lircaea ab. **alenicola.**

F.-w. apical black 4 mm. broad at apex but does not reach 2, its inner edge somewhat dentate. Beneath, apex and margin suffused with greyish. H.-w. beneath with two black quadrate spots near anal angle. In female the f.-w. black reaches inner margin, and in h.-w. underside there is in all areas an obsolescent black submarginal spot. In cell a minute black dot.

I think it extremely improbable that this is a form of *lircaea* at all. It is probably a variety of *eurema.*

lircaea ab. **benitonis.**

Apical band as in *alenicola.* The black marginal band in basal half of costal area is slightly broader and square cut at end. Underside of h.-w. with six distinct black submarginal spots.

lircaea ab. **makomensis.**

Apical band 3·5 mm. broad and extending backwards to 2. H.-w. with black marginal band of ·5 mm. but increased to 1 mm. at apex, and similar on both sides, below with dark grey spots in 1*c*, 2, 4, and 5. Black marginal band in basal half of f.-w. costa not square cut at end.

lircaea ab. **simekoa.**

Resembles Kirby and Smith's figure of *lircaea* female, but marginal band not quite so broad, and more pointed posteriorly. The black quadrate costal spot merely indicated. Underside differs considerably from the figure alluded to, in that the apical and marginal border, though nearly as broad as above, is only a little darkened, without distinct apical spots, whilst in h.-w. submarginal spots are present in 1*c* to 5, in addition to the usual large black spot in 6.

lircaea ab. **bibundica.**

Both sides pure white. Apical band at apex 3·5 mm. broad, ending in a line shortly beyond 2. On underside this band shows through somewhat. A small black spot at apex, and the costal spot projects sharply. The costa between this and base merely lined with black. H.-w. below with only the two usual black spots.

This form is probably a variety of *lagyra.*

lircaea f. **hermansi.**

Ground-colour cream white. F.-w. costa rather narrowly black, usually suddenly narrowing to a line opposite anterior angle of cell, and then widening into a dark apical border, 4–6 mm. wide, which, gradually diminishing in width, extends round margin to the hind angle. H.-w. with a marginal black border 2–3 mm. wide, invaded by the ground-colour at nervule ends so that it has a dentate or subtriangular appearance in the internervular spaces.

Underside. F.-w. as above but dark markings paler, and a well-marked black subquadrate spot on costa opposite end of cell. H.-w. as above but with a large rounded spot in 6, and a spot in 1*c* opposite origin of nervule 2.

lircaea f. **spuma.**

Resembles f. *hermansi,* but has a submarginal row of spots on underside of h.-w.

In the Tring Museum there is a remarkable form of *hermansi* labelled "Tambura, S. Bahr el Ghazal," in which the dark borders, though greyer, are much extended. That of the costa reaches to the subcostal, and the apical darkening, though barely reaching the hind angle, is 8 mm. wide at apex. The h.-w. hind-marginal border is 3 mm. wide, and above shows little indentation. Beneath, the h.-w. shows no trace of submarginal spots, and the usual rounded spot in 6 is merged in the dark border. This is the only example I have seen from this locality, and curiously enough there is also one example of *lircaea lircaea* bearing the same label, and it is quite typical, though if anything with rather less black at f.-w. apex. It would be interesting to have more specimens from this locality. The armature of the *hermansi* form is the same as in the other examples. The *lircaea* form is a female. When Druce described his *Larinopoda spuma* he added that it might be a form of *lircaea*, though he does not give any reason for the suggestion. I have not found in collections any examples of *lircaea* from localities agreeing with those of *spuma* and *hermansi* except the two specimens from Bahr el Ghazal above mentioned. The armatures of *lircaea* and *hermansi* are not distinguishable from each other or from that of *spuma*, though easily recognised as different from those of the other described species, and I am satisfied that these three forms are specifically identical.

lircaea f. innocentia.

Described as resembling Strand's *makomensis*, but differing from all other forms of *lircaea* in the smallness of f.-w. costal spot and the spots in h.-w. 1c and 6. All other markings absent.

LARINOPODA EUREMA. Pl. X, fig. 10; Pl. XI, fig. 5.

Plötz, Stett. Ent. Zeit., 41, p. 199 (1880); Smith and Kirby, Rhop. Exot., 11, p. 38, pl. 9, ff. 7, 8 (1890); Auriv., Rhop. Aeth., p. 273 (1898); in Seitz, Macrolep., p. 329, pl. 63 f. (1914–18).

♂ = *varipes*. Kirby, Ann. Nat. Hist., (5), 19, p. 363 (1887); Smith and Kirby, Rhop. Exot., 2, pl. 2, ff. 5, 6 (1887).

= *libussa*. Staud., Exot. Schmett., 1, p. 268 (1888).

AFRICA, W. COAST. S. LEONE to FRENCH CONGO.

Typical examples may be thus described :—

Exp. about 40 mm. ♂ chalky white. F.-w. with costa rather broadly blackened, slightly wider at cell end, then narrower, and again widening out into apical black which is about 6 mm. wide at apex, and continues in a gradually narrowing hind-marginal border to hind angle.

H.-w. with a marginal black line and within this a dusting of sepia black scales, slight at apex but considerably extended at ends of areas 3 and 2. Black spots of underside showing through rather conspicuously.

Underside. F.-w. as above but dark markings paler. A costal spot above end of cell at which costal black abruptly terminates.

H.-w. with margin as above. In 6 a sub-marginal rounded dark spot and often a minute one above it in 7. A small rounded spot in 1*c* opposite origin of nervule 2, and a larger conspicuous black spot in cell, and sometimes a second minute one above it. ♀ like the ♂ but with only a dark marginal line on h.-w., and reduced dusting of dark scales beneath.

The amount of sepia black scaling in this species varies in both sexes, and minute additional spots sometimes occur on the underside. A male example from Kumassi has nearly as much dark marginal border as *aspidos*, and on the underside there is a second small dark spot beneath that in h.-w. 6.

In some females the dark scaling is reduced to a mere greyish suffusion, but in all the 44 examples before me the spot in h.-w. cell beneath is constant, and this serves to distinguish it from other species except *tera*, from which it can be separated by the pure chalky whiteness of the underside.

The species is very closely allied to *aspidos*, and there is but little difference between the male armatures.

LARINOPODA ASPIDOS. Pl. X, figs. 7, 8; Pl. XI, fig. 4.

H. H. Druce, Ann. Nat. Hist., (6), 5, p. 25 (1890); Karsch, Berl. Ent. Zeit., 38, p. 215 (1893); Auriv., Rhop. Aeth., p. 273 (1898); in Seitz, Macrolep., p. 329 (1914–18).

TOGOLAND. NIGERIA (Lagos, Benin).

f. *latimarginata.*

Gr. Smith, Novit. Zool., 5, p. 354 (1898); Auriv., Rhop.

Aeth, p. 273 (1898); in Seitz, Macrolep., p. 329, pl. 63 f. (1914–18).

NIGERIA (Warri, Lagos).

f. *brenda.* Pl. X, fig. 9; Pl. XI, fig. 2.

H. H. Druce, Ann. Nat. Hist., (7), 11, p. 69 (1903); Auriv., in Seitz, Macrolep., p. 329 (1914–18).

With type form.

Exp. about 40 mm. ♂ chalky white. F.-w. with sepia black on costa extending rather beyond end of cell, where the dark colour widens into a black subapical and marginal border 5–8 mm. wide at apex, gradually narrowing to hind angle, where it is 2–3 mm. wide. H.-w. with a dark border of fairly even width (about 2–3 mm.) extending from apex to anal angle.

Underside with sepia black markings as on upperside. F.-w. with a black dentate mark about middle of costa and h.-w. with a round black spot opposite origin of nervule 2, and a larger submarginal spot in 6, often merged into the black border.

♀ variable, but with less black than in ♂. Generally only with a blackened f.-w. apex, and little or no black beneath except the f.-w. costal spot and the two spots on h.-w.

f. brenda.

In this form, the type of which is a male, the upperside has the appearance of the female of the typical form. Beneath, the f.-w. has the costa rather broadly black as far as end of cell, where the dark colour is somewhat abruptly terminated by the dentate costal spot. Apex paler than on upperside. H.-w. with the usual spots in 1*c* and 6, but with a row of delicate submarginal marks in the internervular spaces in 1*c* to 5, that in 1*c* doubled. Hind and inner margins with a fine black line.

f. latimarginata.

Appears to differ from typical *aspidos* only in that the dark h.-w. marginal border beneath is continued, though more narrowly, along the inner margin. Probably Grose Smith had not seen *aspidos* when he described this form as a species, but it is difficult to understand why Prof. Aurivillius keeps it as a separate species in Seitz's work. It occurs commonly in long series of the type form from Lagos.

The Hope Department possesses long series of *aspidos* taken near Lagos by Mr. Lamborn. Several pairs were taken *in coitu*, and the female is always much less black

than the male. There is, however, considerable variation, and some females have the h.-w. underside much darkened along the margin, especially at anal angle, and where this marginal darkening is obsolescent a submarginal series of spots remains. Some females have also a darkened h.-w. margin on upperside, but apparently never so complete a border as in the male. There is variation from the typical male to the *brenda* form, some males having a reduced blackening on the h.-w. margin. The *brenda* form seems really to be a male with the pattern of the female, the black h.-w. border being practically absent above and reduced to submarginal spots beneath. Occasional female examples are all white above with the f.-w. apices merely greyish. The species and probably the whole genus would appear to be very distasteful, as they are very easily caught, and in fact can be picked up with the fingers.

Larinopoda tera. Pl. X, figs. 11, 12; Pl. XI, figs. 1, 3.

Hew., Ent. Mo. Mag., 10, p. 125 (1873); Auriv., Rhop. Aeth., p. 273 (1898); Neave, Proc. Zool. Soc. Lond., p. 43 (1910); Auriv., in Seitz. Macrolep., p. 329, pl. 63 f. (1914–18).

= *soyauxii*. Dew., Nov. Act. Acad. Nat. Cur., 41, 2, p. 201, pl. 26, f. 10 (1879); Smith and Kirby, Rhop. Exot., 15, p. 51 (1891); pl. 12, f. 9, 10, (as *soxauxii*) (1891); Auriv., Rhop. Aeth., p. 273 (1898).

Cameroon to Uganda.

Exp. 30 to 40 mm. Sexes not markedly different. Typical examples are white or dusky white. F.-w. dusted with sepia on costa and with a sepia brown apical patch some 6 mm. wide at costa and gradually narrowing posteriorly, sometimes reaching hind angle but generally ending in 2. H.-w. often brownish at inner angle and the shaded markings of underside produce a faint pattern.

Beneath the f.-w. has a brown triangular mark on costa opposite end of cell and the apex is shaded with pale brown. The h.-w. has a spot in cell, sometimes two or three, and there may be a spot in 7 and 1*c*, and another on discocellulars. The discal and marginal areas have pale brown undulating markings of a pattern too inconstant to be usefully described.

The undulating shading of the h.-w. underside suffices to distinguish this species. Western examples generally

have the dusky markings most highly developed, and as we proceed eastwards these are gradually reduced until examples from the Toro Forest have a chalky white ground-colour, a mere suffusion of brownish at f.-w. apex, and only a trace of the h.-w. markings beneath. As an exception there are examples from Sesse I., Uganda, as dark as Western forms.

The claspers show a structure allied to that in *aspidos*, but the upper edge is smoother and the spatulate processes less expanded.

LARINOPODA LAGYRA. Pl. X, figs. 4, 5, 6; Pl. XI, figs. 7, 8, 9.

Hew., Exot. Butt. (*Pentila* and *Liptena*) Pl. 1. f. 4 (1886); Smith and Kirby, Rhop. Exot., 24, p. 93, pl. 21, f. 6 (1893); Auriv., Öfvers, Vet. Akad. Förhandl., 53, p. 435 (1896); Rhop. Aeth., p. 272 (1898); H. H. Druce, Proc. Zool. Soc. Lond., p. 362 (1910); Auriv., in Seitz. Macrolep., p. 329 (1914–18).

= *lara*. Staud., Iris, 4, p. 218 (1891); Smith and Kirby, Rhop. Exot., 21, p. 73, pl. 18, f. 1, 2 (1892).

= *lircaea*. Smith and Kirby, Rhop. Exot., 24, p. 95, pl. 21, f. 11, 12 (1893).

CAMEROON. CONGO. TORO.

lagyra f. *gyrala*.

Suff. Iris, xvii, p. 49 (1904); Auriv., in Seitz, Macrolep., p. 329, pl. 63 f. (as *gyrula*) (1914–18).

With typical forms.

lagyra f. *emilia*.

Suff. *l. c.* p. 48 (1904); Auriv., *l. c.* p. 329 (1914–18).

With typical forms.

lagyra f. *punctata*.

Druce, Proc. Zool. Soc. Lond., p. 361 (1910); Auriv., *l. c.* (1914–18).

The name *lagyra* is at present applicable to forms of *Larinopoda* described below, but it would appear that there are in fact three species which are not distinguishable on outward characters.

lagyra lagyra.

Exp. 30 to 50 mm. No constant difference in markings of sexes. Ground-colour chalky white. F.-w. with sepia black scaling on

costa from base to about middle, where it may be suddenly narrowed or may run over into apical black. The latter varies from about 10 to 3 mm. wide at apex, and may extend as a marginal border as far as 2 or to hind angle. H.-w. chalky white, spots of underside showing through from beneath.

Underside. F.-w. as above, but apical black paler. Every gradation from this to a mere black marginal line and a blackish spot at apex in 7. A subtriangular costal spot opposite end of cell. H.-w. chalky white with a rounded dark spot in 6, sometimes a smaller one in 5, or in 5 and 7. A small spot in 1c opposite origin of nervule 2. Sometimes a double spot at anal angle.

The *lagyra* forms are distinguished from *eurema* by the absence of a spot in h.-w. cell beneath, and from *aspidos* female by the fact that the latter nearly always has at least a dusting of brownish scales near anal angle of h.-w. beneath. This character is not, however, quite constant and there are females of *aspidos* that cannot with certainty be distinguished from *lagyra*.

Suffert's name *gyrala* is applicable to forms in which the f.-w. costal black is rather broad and runs over into the apical black, whilst there are small spots on h.-w. underside in 5 and 7. The same author's *emilia* is even less distinctive, merely having the f.-w. apical black rather broader than in the type. Druce's *punctata* has a submarginal row of spots on the h.-w. underside.

The forms referable to *lagyra* present considerable difficulties from a taxonomic point of view. If we deal with them on the structure of the male armature, then we must conclude that there are at least three species, one of them very distinct. On Plate XI are drawings of the armatures of these three forms. Fig. 9 represents the claspers of a specimen from the Ja River district in S. Cameroon. The claspers are bifid, thus differing from those of other species of the genus. Fig. 8 is taken from an example from the Upper Kassai district. Here the claspers are still bifid, but the lower fork is much longer than the upper. Fig. 7 is from a specimen taken at Port Victoria, Cameroon, and differs entirely from 9 and 8 and from all other preparations examined. Nearly 60 specimens of the *lagyra* form are before me, and careful comparison shows that whilst they vary in the extent of the f.-w. black, and in the spotting of the h.-w. underside, there are no constant pattern characteristics correlated

to the three forms of genitalia described that would enable us to separate them into three species. There are examples from Gaboon, Ituri Forest, and Toro, but unfortunately most of them are females. One male Toro specimen has claspers like 8, and an example from Buamba Forest, Semliki Valley, is somewhat intermediate between 8 and 9, though closer to 8.

In the genus *Neptis* we have *N. swynnertoni* and *N. neavei* from Mt. Chirinda and Mt. Mlanje respectively, presenting differences in the claspers without constant differences in the external characters, but here there is comparative isolation by separate elevated positions.

Judging from a modelled map of Africa there would seem to be no insuperable physical barrier to account for an asyngamic isolation of the Ja River and Port Victoria specimens, and yet the difference between these two is very marked. In the absence of sufficient material from intermediate localities, if indeed the butterfly occurs in such districts, we can do little more than record the fact that the name *lagyra* at present applies to a series of forms so far outwardly indistinguishable, but including at least three probably asyngamic communities.

With the exception of the forms of *lagyra* the species of *Larinopoda* seem well defined and the armatures distinctive and constant. An incident in the present investigation supports this view. Amongst the material of *lagyra* I found a single example from Sierra Leone. On making a preparation of the armature I was surprised to find that the structure was the same as in *eurema*, the species which is distinguished by having a black spot in the h.-w. cell beneath. There appeared to be no trace of this spot till I made a microscopical examination, when I found, where the spot should be, a few grey-black scales. The specimen is, in fact, an example of *eurema* with the spot almost obsolete.

Explanation of Plate X.

Fig. 1. *Larinopoda lircea lircea* Butl. ♂, N. Cameroon (Coll. Joicey).
2. ,, *lircea* ♀, near *hermansi* Auriv. (intermediate between *hermansi* and *lircea*), Ja River, Bitje, Cameroon (Coll. Joicey).
3. ,, *lircea* f. *spuma* Druce ♂, Ja River (Mus. Tring).
4. ,, *lagyra* Hew. ♀, Upper Kassai River (Oxford).
5. ,, ,, ♀, Ja River (Tring).
6. ,, ,, ♀, ,, ,, ,,

(This example is figured to show that the shape and extent of the f.-w. apical black is not constantly different in Ja River and Kassai River examples.)

7. *Larinopoda aspidos* Druce ♂, Oni, Nigeria (Oxford).
8. ,, ,, ,, ♀ ,, ,, ,,
9. ,, ,, f. *brenda* Druce ♂, Oni, Nigeria (Oxford).
10. ,, *eurema* Plotz. ♂, S. Leone (Tring).
11. ,, *tera* ♀, Ogowe (London).
12. ,, ,, ♂, Toro Forest (London).

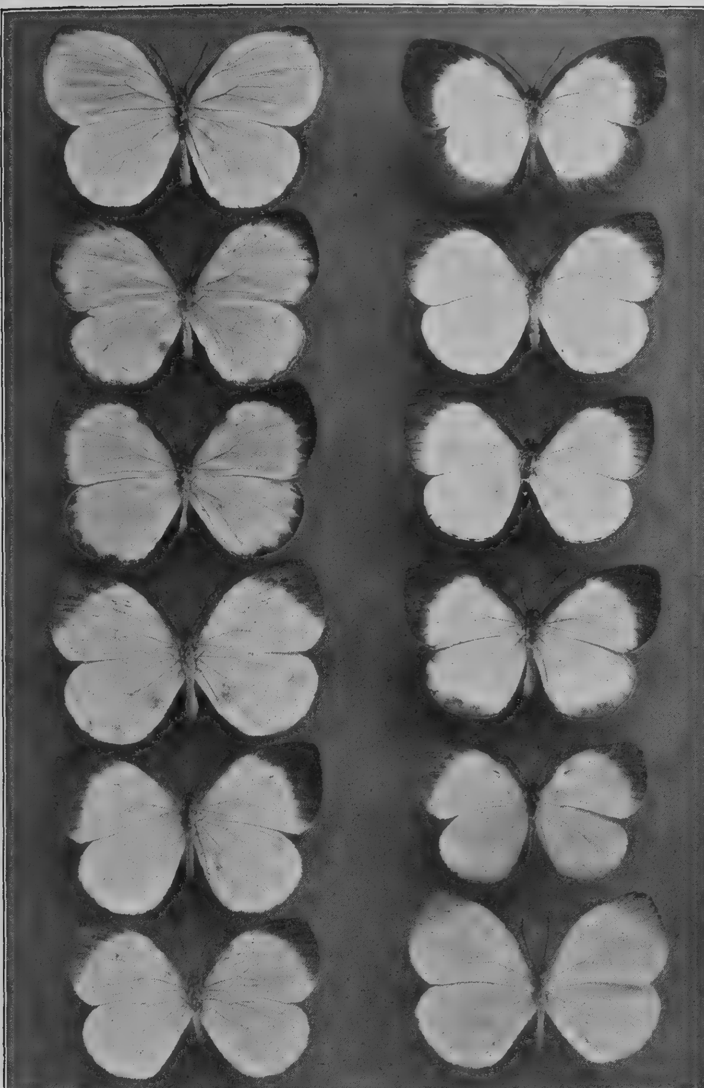
(Examples from the last locality are whiter, generally larger, and have less shading in h.-w. beneath.)

Explanation of Plate XI.

Male Armatures.

Fig. 1. *Larinopoda tera* (claspers).
2. ,, *aspidos* f. *brenda*.
3. ,, *tera* (girdle).
4. ,, *aspidos aspidos*.
5. ,, *eurema*.
6. ,, *lircea lircea*.
7. ,, *lagyra* (Port Victoria).
8. ,, ,, (Upper Kassai River).
9. ,, ,, (Ja River, Cameroon).

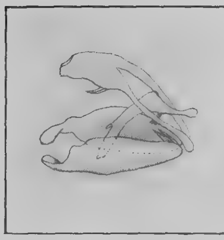
1 2 3 4 5 6



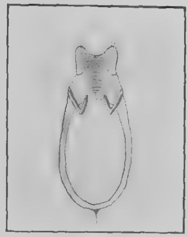
7 8 9 10 11 12

FORMS OF LARINOPODA

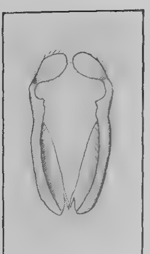
1



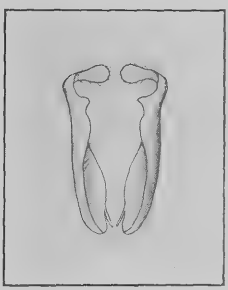
2



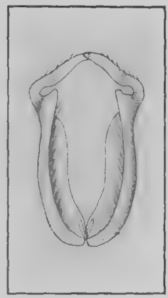
3



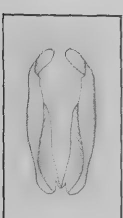
4



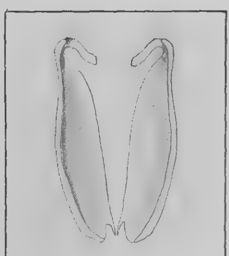
5



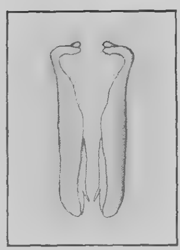
6



7



8



9

H. Eltringham del.

GENITALIA OF LARINOPODA

X. *The* charina *Group of* Pinacopteryx. By F. A. Dixey, M.A., M.D., F.R.S., Subwarden of Wadham College, Oxford.

[Read May 1st, 1918.]

The assemblage of Pierine species including *cebron* and *capricornus*, Ward, *pigea* and *charina*, Boisd., with others nearly related to them, forms a natural group which may either be considered as a separate genus under the name of *Pinacopteryx*, or as a section of *Pieris* in the wide sense; the latter course being taken by Trimen in "South African Butterflies," vol. iii, p. 39; and by Aurivillius in Seitz's "Macrolepidoptera: Ethiopian Region," Eng. trans., p. 45.

In Proc. Ent. Soc. Lond., 1912, pp. cx–cxiv, it was remarked that the group headed by *P. charina* was distinct in several particulars from the remainder of the section or genus, and in the same "Proceedings" for 1909, pp. cix, cx, some account was given of the peculiarities of the scent-scales which characterise this *charina* group; an outline figure being added of the curious plume-scale of *P. liliana*, Gr. Smith (*Ibid.*, Pl. E, fig. 10). I now propose to deal in somewhat greater detail with the members of this section, as regards which there has been a certain amount of confusion.

The *charina* group, as has been pointed out by Aurivillius,* is distinguished from the remaining species of *Pinacopteryx*, which may be called for convenience the *pigea* group, by the possession on the lower discocellular vein of both wings, or at least of one wing, of a black spot or dot beneath, often occurring on the upper surface also. This, though in practice a useful distinction, does not invariably hold good; for in one or two forms of the *pigea* section a dot may be present in the assigned situation, and in one form at least of the *charina* section both surfaces of both wings may be devoid of any such marking.

A more constant distinction, so far as the males are concerned, is afforded by the genitalia.† In all the species

* *Op. cit.*, p. 46.

† This, I believe, was first observed by my friend Dr. H. Eltringham.

of the *pigea* group, the clasper ends posteriorly in two spinous prolongations, one placed dorsally to the other (fig. 1). These are usually very well marked; but in one species, viz. *P. spilleri*, Stdgr., they are exceptionally short, though still easily visible. In the *charina* group the clasper is furnished posteriorly with only one spine instead of two (fig. 2).

Fig. 1.—*P. orbona*, Hübn. Doubled spine of clasper × 54.

The members of this latter group are probably best regarded as a single species including several geographical forms of subspecific rank. The form which is most distinctly marked off from the rest would seem to be *charina* itself. This was described by Boisduval from males and females captured in Kaffraria. Aurivillius in Seitz, *loc. cit.*, gives the distribution of *charina* as "South Africa to German East Africa," but I have not seen any specimens of this southern subspecies from further north than the Transvaal. Another form which seems to be easily distinguishable is that described by Grose Smith * as *Belenois* *liliana*, and figured by Grose Smith and Kirby † as *Pinacopteryx liliana*. The locality given by the describer is Mombasa, and the same form is found in the surrounding region at least as far to the west and north as Taveta and

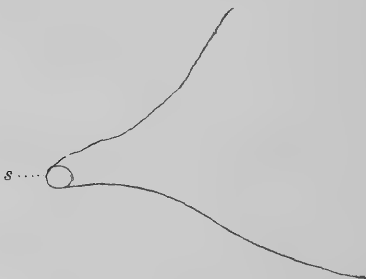


Fig. 2.—*P. charina*, Boisd. Single spine of clasper × 54.

* Ann. Mag. Nat. Hist., Series 6, vol. 3, p. 122 (1889).
† Rhop. Exot., *Pinacopteryx*, Pl. I, figs. 7, 8 (♂), 9 (♀).

Machakos. *Pinacopteryx gerda*, figured and described by Grose Smith and Kirby (*loc. cit.*, figs. 10, 11), also from Mombasa, is probably a male of *P. liliana* somewhat smaller than the average and less heavily marked with black. Specimens from the Voi River, the Tana River and Mlegwa, all in British East Africa, correspond in appearance with *Pinacopteryx gerda*.

There remain certain forms, allied to the foregoing and to each other, which have been known under the names of *P. doxo*, Godt., *P. simana*, Hopff., and *P. venata*, Butl. *P. doxo* was the first member to be noticed of the whole *charina* group. It was described by Godart * in 1819 as *Pieris doxo*. Godart's type is in the Dufresne Collection, now at Edinburgh, and has been figured by Mr. P. Grimshaw in Trans. Roy. Soc. Edin., vol. xxxix, Pl. I, fig. 6 (1900). It is a female in somewhat poor condition. The locality is left blank by Godart; but Boisduval,† who reproduces Godart's description, says, "Afrique probablement." A careful examination of the type specimen makes it tolerably clear that it is a *Pinacopteryx* of the group at present under discussion, though it is by no means easy to assign it to its proper place among the forms included in that section. On the whole I should be disposed to agree with Aurivillius (*loc. cit.*, p. 46) that it belongs to the form afterwards described by Hopffer as *Pieris simana* (types from Mozambique), were it not improbable that any of Dufresne's collection came from that region. As the case stands, I suspect that Godart's type may be really a somewhat unusual example of the wet-season form of *P. charina* from the region of the Cape. It is, however, not exactly like any *Pinacopteryx* that I have ever seen, and it differs considerably from the figure of "*doxo* ♀" in Seitz, *op. cit.*, Pl. XIV, e. This figure, indeed, probably represents a dry-season female of Grose Smith's *liliana*, and was certainly not drawn from Godart's type.

The type of *P. doxo* thus being a battered female of unknown locality, its determination is so uncertain a matter that I venture to think it best to drop the name altogether as a specific or subspecific designation. The next question to arise is that of the relation of *P. simana* to *P. venata*. Butler's type of *P. venata*, a female, came from the White Nile; it was described and figured by him

* Enc. Méth., ix, p. 123, n. 15.
† Sp. Gén., I, p. 527, n. 130 (1836).

in Trans. Ent. Soc. Lond., 1871, p. 169, Pl. VII, fig. 7, as *Ixias venatus*. The male of this form was unknown until 1902, when Mr. Loat captured one at Gondokoro; this was described in Trans. Ent. Soc. Lond., 1903, p. 152. The male type and a female from Shambî on the White Nile were well figured by Dr. Longstaff.* *P. simana*, as already stated, was described by Hopffer from Mozambique. Both sexes are figured by Peters.† The name *venata* is not inappropriate to Butler's type, which is somewhat heavily marked, and has the veins accentuated with black. In many other female specimens (probably of the dry season), and in all the males with which I am acquainted, the black veining is absent from the upper surface. In *P. simana*, on the other hand, although the females vary in this respect, probably, like those of *P. venata*, according

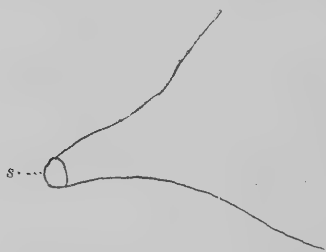


Fig. 3.—*P. liliana*, Gr. Smith. Spine of clasper × 54.

to season, the males appear always to have the veins on the upper surface more or less marked out with black. On these and other grounds presently to be mentioned, I think that *simana* and *venata*, though no doubt closely allied, are separable as subspecies.

It may then be said, at least provisionally, that there are four, or perhaps five, subspecies which can be ranked under the head of *Pinacopteryx charina*. It will be of interest to see what light can be thrown on the mutual relations of these forms by an examination of structural details.

(1) *The Male Genitalia.*—As already remarked, the clasper in all these forms ends posteriorly in a single spinous projection. This in a specimen of *P. liliana* from Mombasa is long and slender (fig. 3). In an example of

* Trans. Ent. Soc. Lond., 1913, Pl. II, figs. 1, 2, 3.

† *Reise nach Mossambique*, Taf. XXIII, figs. 3–6.

P. charina from Weenen, Natal (fig. 2), it is also long, but markedly less so than in *P. liliana.* The terminal spine in a *P. simana* from Gazaland (fig. 4) and a *P. venata* from Gondokoro, White Nile (fig. 5), is short; it is somewhat blunter in *simana* than in *venata.* A point to be noted is that, judging from these examples, the clasper of *charina*, a comparatively small form, is not much less in size than that of *liliana*, decidedly a larger insect. The claspers of *simana* and *venata* are much smaller. In all four forms the terminal spine is furnished at its free extremity with a socket from which proceeds a group of chitinous bristles. These are not represented in the figures. The socket is indicated at *s*.

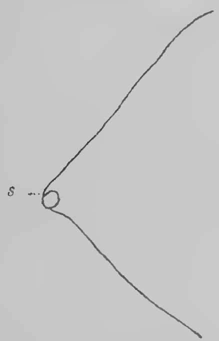


Fig. 4.—*P. simana*, Hopff. Spine of clasper × 54.

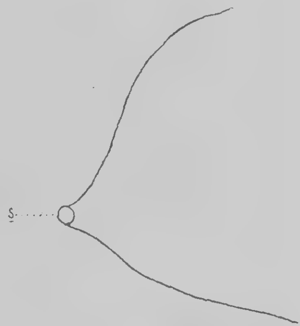


Fig. 5.—*P. venata*, Butl. Spine of clasper × 54.

There is also a difference to be observed between the two sections of *Pinacopteryx*, in reference to the character of the uncus. This structure in the *charina* group is comparatively slender, and rather sharply pointed. The dorsal margin is slightly sinuous in outline, and the distal portion of the uncus is curved downwards, sometimes so decidedly as to give the organ almost a sickle-shaped character (fig. 7). In the *pigea* group, on the other hand, the dorsoventral dimension is proportionately greater, the free extremity is comparatively blunt, the dorsal margin is uniformly convex, and the curve of the organ, though present, is less pronounced (fig. 6).

(2) *The Scent-scales.*—These, as elsewhere noted, present

in all the forms the general appearance of an elongated lamina with rounded base and parallel sides. In specimens of *P. liliana* from Mombasa, Taveta, the Dabida Hills, Thiba River and near Machakos, the rounded base is

Fig. 6.—*P. pigea*, Boisd. Uncus × 54.

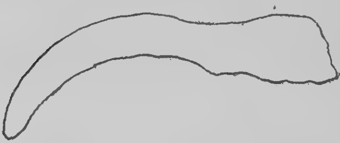


Fig. 7.—*P. gerda*, Gr. Sm. and Kirb. Uncus × 54.

greatly expanded and takes up by far the greater part of the area of the lamina. The outline of the scale thus becomes flask-shaped, the neck of the flask being represented by the portion of the lamina distal to the basal expansion (fig. 8). The scent-scales of a male specimen from Mombasa which corresponds with the description and figure of *P. gerda* by Grose Smith and Kirby, exhibit precisely the same characters as the foregoing. This appears to favour the impression that the only difference between *gerda* and *liliana* is one of season. The specimens above referred to (p. 193) from the Voi River and Mlegwa closely resemble in aspect the "*gerda*" from Mombasa; their scent-scales, however, present a different appearance, the basal expansion being much reduced (fig. 9). So far as outline goes, they are much like the corresponding structures in *P. simana*, but they possess one character in common with *P. liliana* which is not shared by *simana*; and which, in conjunction with another feature presently to be mentioned, seems to indicate

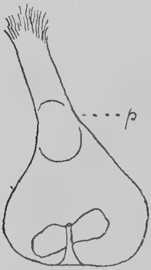


Fig. 8.—*P. liliana*, Gr. Sm. Scent-scale × 310. *p*, granular patch.

that these Voi River specimens may be regarded as a slightly divergent form of *P. liliana*. Whether Smith and Kirby's name of *gerda* may properly be applied to them is perhaps open to question. The character of the scent-scale just alluded to is the occurrence, at or near the junction of the neck with the body of the flask, of a rough-looking granular patch, dark by transmitted light, most conspicuous in *liliana* from Mombasa, but easily recognisable in the *gerda*-like specimens above mentioned (figs. 8, 9, *p*). This appearance is not seen in the scent-scales of *charina*, *simana* or *venata*; a diffused shading, but no definite granular patch, being the nearest approach visible in the corresponding situation.

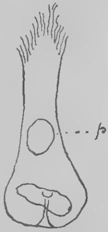


Fig. 9.—*P. gerda*, Gr. Sm. and Kirb. Scent-scale × 310. *p*, granular patch.

When I first investigated the scent-scales in this group, working with somewhat limited material, I formed the opinion that *P. venata* could be easily distinguished from *P. simana* by the shorter and broader character of its scent-scales.* This was the case with the specimens from which my preparations were made; but the examination of additional examples has shown that the distinction does

Fig. 10.

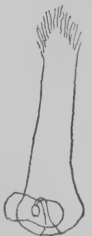


Fig. 11.

Fig. 12.

Fig. 10.—*P. charina*, Boisd. Scent-scale × 310.
Fig. 11.—*P. simana*, Hopff. Scent-scale × 310.
Fig. 12.—*P. venata*, Butl. Scent-scale × 310.

not universally hold good. It occasionally, though rarely, happens that a scent-scale from an undoubted specimen of *P. venata* (as in one from Hagarat in South Kordofan) is as long as an exceptionally short scale from *P. simana*; and similarly, a scale here and there from *P. venata* (as

* Proc. Ent. Soc. Lond., 1912, p. cxiii.

in a specimen from Gondokoro on the White Nile) is narrower in proportion than the usual scale of *P. simana*. But there is no doubt that a comparison of the average dimensions of the scent-scales in the two forms shows the distinction above stated. The scent-scale in *P. charina* is much like that in *P. simana*, but here again it is on the average shorter, though not so short as that of *P. venata* (figs. 10, 11, 12).

It was mentioned on p. 196 that in addition to the dark granular patch of the scent-scale, there was another feature which would seem to indicate that the Voi River and Mlegwa specimens are a form of *liliana* rather than of *simana*. This is the presence of a well-marked dark spot on the upper surface of the fore-wing of the female, situated between the median and submedian veins and usually extending into the space below the submedian. The spot in question is characteristic of the wet-season and intermediate females of *liliana*, including the "*gerda*" form from Mlegwa and the Voi River, but appears to be always absent, or at most only represented by a very slight powdering of dark scales, in the females of *charina*, *simana* and *venata*. Judged by this criterion, as well as by the evidence of the scent-scales, there appears to be no doubt that the "*gerda*" forms are rightly associated with *liliana* and not with *simana*.

It may be well here to recapitulate in some detail the chief points that call for notice in regard to these several forms.

(1) *P. charina*, Boisd.—This is the form which is found in Cape Colony, Natal, Zululand, and (probably) the Transvaal. Both males and females are without black veining. The male is nearly always without any discocellular spot on the upper surface, but possesses one on the lower surface of the hind-wing, and occasionally of the fore-wing; the latter, if present, being minute. On the upper surface of the fore-wing of the female the discocellular spot may be present or absent; it appears to be always absent from the hind-wing. Beneath, in the female, it is constantly present in the hind-wing and often visible on the fore-wing as well. The upper surface of the male may be entirely immaculate; but on the fore-wing there is usually a dark streak bounding the costa, and a marginal series of dots on the hind border, which are often discrete, but may be merged into a dark band

never very broad. A similar marginal band in the female is usually broader and better marked, but may be almost obsolete. The female has a chain of subapical spots on the fore-wing, reaching from the costa to the space below the first radial branch; a larger spot occupies the space between the second and third median; this is usually isolated, but a minute spot sometimes occurs below the second radial, completing the chain. Both sexes show a pearly lustre at the base of the wings on the upper surface; this extends over a larger area in the female than in the male. The under surface of the hind-wing and apical area of the fore-wing are pale yellow, marked in the dry-season form of both sexes with a rich irroration of dark specks or blotches; the submarginal spots of the female are visible beneath, being more or less assimilated to the irroration. The male has occasionally on the underside an indication of the costal end of a corresponding submarginal chain; but from this sex the spot between the second and third branches of the median is nearly always absent, though it may be present in the wet-season form as a small dot. In the wet season also the irroration becomes reduced to a series of small submarginal spots, sometimes very faintly marked. In both sexes the veins of the hind-wings on the upper surface and both wings of the lower surface may possess minute marginal dark dots. These may be present at all seasons. The male clasper in a specimen from Natal is larger than in *P. simana* and *P. venata*; it resembles that of *P. liliana* in size and in the length of the single posterior spine (fig. 2), which is nearly as long as in that subspecies. The uncus (fig. 13) is small relatively to the size of the clasper. The lamina of the scent-scale has parallel sides and an expanded and rounded base. In size it is intermediate between those of *P. simana* and *P. venata*.

(2) *P. simana*, Hopff.—This is the form found in Portuguese and German East Africa, Rhodesia, British Central Africa, Uganda and British East Africa with the exception of the coast region about Mombasa, where it is replaced by *P. liliana* and *P. gerda*. In this subspecies the male is invariably veined on the upper surface, more distinctly so in the wet than in the dry season. In both sexes the dark border of the fore-wing is continuous, showing little tendency to break up, as in *charina*, into a series of marginal spots. In both wet- and dry-season phases of the female

there is a strong tendency for the apical portion of the dark border to fuse with the submarginal series of dark spots, thus forming a well-marked apical patch. A small discocellular spot may be present on the fore-wing of the male, especially in specimens from west of Lake Victoria Nyanza, but only in rare instances on the hind-wing. A similar discocellular spot is always present on the fore-wing of the female, and in the wet-season form on the hind-wing as well. Very rarely there may be in the female a slight indication of a dark spot in the space between the median and submedian veins of the fore-wing; this is shown in the figure of the type in Peters' *Reise.** Beneath, the general surface of both wings in the wet-season male is white with more or less dark veining; this veining in a series of males from west of the Victoria Nyanza is extremely well marked, especially on the hind-wing. A submarginal series of spots is more or less visible on both fore- and hind-wing. These in the series last referred to are highly developed, and are frequently united into a conspicuous submarginal band, which, however, in the fore-wing does not extend further backward than the space between the second and third median branches. The discocellular spots are always present on both fore- and hind-wings. The underside of the wet-season female varies a good deal according to locality. The hind-wing and apex of fore-wing are usually yellow; the remainder of the fore-wing, white. The submarginal spot between the second and third median is always conspicuous, the rest of the submarginal series may disappear. There is, however, nearly always a submarginal chain visible on the hind-wing, and in females from west of the Victoria Nyanza the submarginal band is as well developed on both wings as that of the males from the same region. The discocellular spots are always present, as in the male. In the dry season the hind-wing and apical area of the fore-wing in both sexes become overspread by a brownish irroration, with which the dark markings become assimilated. The powdering is usually more blurred and of a paler brown than in *charina*; the discocellular spots, as above noted, are present in both sexes. The clasper in a male from Gazaland is small; its posterior spine (fig. 4) is blunt, not prolonged as in

* *Reise nach Mossambique,* Taf. XXIII, figs. 5, 6.

charina. The uncus (fig. 14) is abruptly curved at its distal end. It bears some resemblance in outline to the upper mandible of the beak of a gull. The scent-scale (fig. 11) is like that of *charina*, but generally longer.

(3) *P. liliana*, Grose Smith.—This is a well-marked subspecies from Mombasa and the adjacent region, including Taveta and Machakos. It is on the average considerably larger than any of the other forms of the *charina* group. The wet-season male is veined with black on the upper surface, and is somewhat heavily marked with grey on the inner half of the costa of the fore-wing and the base of both wings. The apex and posterior margin of the fore-wing are margined with black. There are no discocellular spots on either wing. The wet-season female may be either white or yellow on the upper surface; it has a broad dark

FIG. 13.—*P. charina*, Boisd. Uncus × 54.

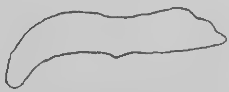


FIG. 14.—*P. simana*, Hopff. Uncus × 54.

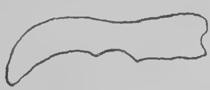


FIG. 15.—*P. venata*, Butl. Uncus × 54.

border to the fore-wing, with which the costal part of a submarginal chain is usually merged. The hind-wing is bordered by a series of large dark spots, sometimes fused together. The submarginal spot between the second and third median branches is very large and conspicuous; and there is always visible a spot, belonging to the same series, in the space between the median and submedian, usually passing the boundary of the latter vein. A submarginal band or row of spots is sometimes visible on the hind-wing. A discocellular spot is always present on the fore-wing, and usually on the hind-wing also. Beneath, the wet-season male is white with small dark marginal dots and a chain of submarginal brownish spots, more or less developed, on both fore- and hind-wings. Discocellular spots are present on both wings, and there is a large and conspicuous submarginal spot between the second and third median

branches, occupying the same position as in the female. In the wet-season female the costa and apex of the fore-wing and the whole of the hind-wing are usually yellowish beneath. The submarginal chain of spots is present on both wings; the spot on the fore-wing between the second and third median being large and conspicuous, as on the upper surface. Discocellular spots are present on both wings. In the dry season the male may show above little or no trace of dark veining. The dark markings of the female are also much reduced, but the large spot between the second and third median branches is still present and conspicuous on the fore-wing; the hind-wing may be spotless, though there is usually a marginal series of dark spots. A discocellular spot is generally present on the

FIG. 16.—*P. liliana*, Gr. Smith. Spine of clasper × 54.

fore-wing, but not on the hind-wing. Beneath, the male may be spotless but for the large median spot, which persists. The female often shows a slight mottling on the hind-wing and apex of the fore-wing, to which the submarginal spots are assimilated. This mottling is comparatively pale, and the powdering specks are usually more sparsely distributed than in most specimens of *P. charina*. Discocellular spots are present on both wings, but may be very faint. The clasper in a male from Mombasa is large, like that of *P. charina*; and ends posteriorly in a long spur (fig. 3), still longer than the corresponding structure in that subspecies. The clasper of another Mombasa specimen, which corresponds in appearance with Grose Smith and Kirby's *P. gerda*, is of the same *liliana* character, but with a somewhat shorter spine (fig. 16). The uncus of the first-named Mombasa specimen (fig. 17)

is long and slender, shaped like a surgeon's curved bistoury. That of the *gerda*-like specimen (fig. 18) is of similar character, but slightly sharper at the tip. The scent-scale is of the remarkable shape described on p. 196, and is characterised by the presence of a dark granular patch at the junction of the narrow portion of the lamina with its expanded base (fig. 8, *p*).

(4) *P. gerda*, Grose Smith and Kirby.—The type described and figured under this name,* from Mombasa, is probably a dry-season male of *P. liliana*; but there is a form, as

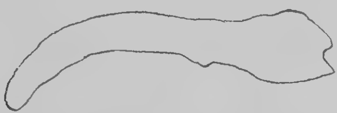


Fig. 17.—*P. liliana*, Gr. Smith. Uncus × 54.

already mentioned, occurring at Voi, Mlegwa and Maranga (all in British East Africa), the male of which is identical in appearance with *gerda* as figured and described, and to which the same name may perhaps be applied, at all events provisionally. The upperside of the male in this form appears to be always free from dark veining, and the dark margin of the fore-wing is somewhat further prolonged

Fig. 18.—*P. liliana*, Gr. Smith. Uncus × 54.

towards the anal angle than in *P. liliana* ♂. There is usually an indication of a discocellular spot on the fore-wing, but not on the hind-wing. Beneath, the general surface of both wings may be white, as in a specimen from Mlegwa (January) and one from Voi (May); or the hind-wing and apex of fore-wing may be yellow; pale, as in another specimen from Voi (May), or deeper, as in two from Voi (October). The discocellular spots are present on both wings, but very faint on the hind-wing in both

* Rhop. Exot., *Pinacopteryx*, Pl. I, figs. 10, 11.

specimens captured in October. The large median spot is always present, and there may be an indication of a submarginal series on the hind-wing. The female is like a wet-season or intermediate female of *P. liliana*, though usually smaller. It always possesses on both surfaces the

Fig. 19.—*P. gerda*, Gr. Sm. and Kirb. Spine of left clasper × 54.

spot between the median and submedian of the fore-wing, as in those forms, and the discocellular spots on fore- and hind-wing. The claspers in a male from Voi (figs. 19, 20) are curiously unsymmetrical; the right valve ending posteriorly in a sharp spine like that of *liliana* from Mombasa,

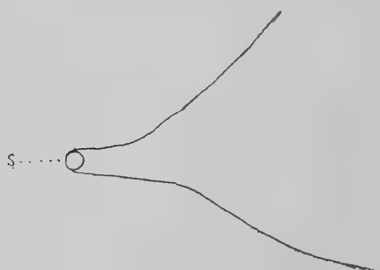


Fig. 20.—*P. gerda*, Gr. Sm. and Kirb. Spine of right clasper × 54.

and furnished, as in that form, with a terminal socket from which protrudes a group of large chitinous bristles; the left valve also ends in a spine, but this, besides being shorter and broader, is entirely destitute of a terminal socket. The uncus of the same specimen (fig. 7), though like that of *P. liliana*, is more deeply curved. It may be

called sickle-shaped. The scent-scales in two males from the Voi River (fig. 9) and one from Mlegwa are of the *liliana* rather than of the *simana* type. The basal expansion takes up more of the lamina and is more rounded than in *simana*, but is much smaller and less rounded than in *liliana*. Like the corresponding structure in the latter form, the lamina shows a dark, granular, circular or oval patch at the junction of neck with body (fig. 9, *p*).

(5) *P. venata*, Butl.—This is the form which is found in the White Nile region, Abyssinia (Lake Rudolph Expedition), Southern Kordofan and the Southern Sûdân at least as far west as the Shari-Tchad Protectorate. It is generally smaller than *P. simana*, and, especially in the dry season, is sharper-winged in both sexes than that insect. The upper surface of the male differs also from that of *P. simana* in showing no dark veining; it may possess in the wet season a few black scales in the situation of the discocellular spot of the fore-wing, but is generally destitute of all traces of these spots except a slight discoloration showing through from beneath. The fore-wing possesses a dark apical patch passing into a hind-marginal band; this patch and band in the dry season may become pale and may almost disappear. There is also on the hind-wing a row of marginal spots, often absent in the dry season. Beneath, the male is white; in the wet season the submarginal series is very often absent, but may be indicated by a more or less complete chain of dark spots. In the dry season the submarginal chain is usually better developed; it is paler in colour, and on the hind-wing frequently forms a festooned linear band. A slightly-marked brownish irroration may be present on the hind-wing and the apex of the fore-wing. There is generally some dark veining on the apex of the fore-wing and outer portion of the hind-wing at both wet and dry seasons. The discocellular spots are always present; a marginal row may also occur, especially in the wet season. On the upper surface of the female the dark apical patch is broader than in the male; as in that sex, it passes into a continuous hind-marginal band, darker and more pronounced in the wet season than in the dry. In the wet season the dark veining of both wings is usually well marked, as in Mr. Butler's type; the hind-wing also carries a series of large dark marginal spots. The submarginal chain of the

fore-wing ends in a large spot between the second and third median branches; there is no spot below the median, such as occurs in *P. liliana*. A discocellular spot is present on both wings in the wet season; in the dry season it is often absent from the hind-wing, and sometimes from both. Beneath, the hind-wing and apex of the fore-wing are yellow, varying in degree of intensity; the remaining area of the fore-wing is white, often with a yellowish shade at the base. The veins of the hind-wing and of the apex of the fore-wing are marked with dark lines, paler in the dry season; at which period the same areas may also show a slight reddish-brown irroration. Except in the extreme dry-season form, a marginal row of spots is generally to be found on the hind-wing. The submarginal series of spots is usually present at both seasons, on the hind-wing taking the form of a more or less continuous festooned line; on the fore-wing it may be very slightly developed, but always includes the characteristic spot between the second and third median. As on the upper surface, there is no spot posterior to the median. Discocellular spots appear to be always present on both wings. It may be observed that the dry-season specimens from the White Nile are sharper-winged than the generality of examples from Kordofan, and are also more conspicuously marked. It is especially noticeable in the latter assemblage that all the markings of the female on both surfaces are in the dry season of the same reddish-sandy tint. In the wet season the corresponding markings are dark brown or black. The clasper of a male from Gondokoro ends posteriorly in a spine (fig. 5) which is much blunter than that of *P. charina*, *liliana* or *gerda*, but is slightly less blunt than that of a *P. simana* from Gazaland. The uncus (fig. 15) is like that of *P. simana*, but is still more sharply bent downwards at the tip. The scent-scale (fig. 12) is somewhat variable; but on the average is shorter, and broader in proportion than that of *P. simana*, which it otherwise resembles.

P. simana and *P. venata* are no doubt closely related, though typical specimens are easily distinguished. They may perhaps intergrade in Uganda.

The chief points of distinction between *Pinacopteryx* of the *charina* group may be summarised in tabular form as follows :—

	Distribution.	Dark venation (♂)	Submedian Spot.	Spine of Clasper.	Uncus.	Scent-scale. Average length of lamina.
P. charina, Boisd.	Cape Colony, Natal, Zululand, Transvaal.	Absent.	Absent.	Long.	Moderately long; slightly curved.	0·086 mm.
P. simana, Hopff.	Portuguese and "German" East Africa, Rhodesia, British Central and East Africa (except the neighbourhood of Mombasa), Uganda.	Present.	Rarely a faint indication in ♀.	Short; very blunt.	Short; sharply curved.	0·098 ,,
P. liliana, Grose Smith.	Mombasa and neighbourhood.	Present in ⊗. Absent in ♂.	Present in ⊗ and ⊖.	Long.	Long; slightly curved.	0·115 ,,
P. gerda, Grose Smith and Kirby.	Voi River, Maranga, Mlegwa (Br. E. Africa).	Absent.	Present in ♀.	Long.	Long; sharply curved.	0·092 ,,
P. venata, Butl.	White Nile, Abyssinia, Southern Kordofan, Southern Sûdân.	Absent.	Absent.	Short; blunt.	Short; sharply curved.	0·076 ,,

Before closing this paper, I should wish to say that I am far from supposing that the statements and conclusions therein contained are necessarily final. It is quite possible that a more minute examination of existing specimens, or an accession of fresh collections from the above and other districts, might render necessary a modification of the present results. I can only claim to have done my best with the material at my command; this comprises the series in the National Collection at the British Museum and the Hope Collection at Oxford, the latter containing the very valuable consignments from Capt. R. S. Wilson (Southern Kordofan), Mr. W. S. Loat and Dr. G. B. Longstaff (White Nile), the Rev. K. St. A. Rogers (British East Africa), Mr. C. A. Wiggins (Uganda), Dr. G. D. H. Carpenter ("German" East Africa), Mr. S. A. Neave (Rhodesia), Dr. Longstaff and Mr. G. A. K. Marshall (Cape Colony, Natal, Gazaland and Mashonaland), with others. The care taken by all these gentlemen to furnish their specimens with exact and ample data as to locality and time of capture calls for grateful recognition on the part of those to whom belongs the task of working out and co-ordinating the material provided by their several collections. It is impossible to overestimate the value, for bionomic purposes, of accurate notes of this description.

To Dr. Eltringham I am indebted for the preparation of a long series of genitalia, from which most of the outline figures which accompany this paper have been drawn. My special thanks are due to him for this and other help which has always been most cordially given.

TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR 1915.

I. *New Species and Subspecies of* Pierinae. By F. A. Dixey, M.A., M.D., F.R.S., Fellow of Wadham College, Oxford.

[Read May 6th, 1914.]

PLATES I, II.

The following forms, some of which appear to be of specific and others of subspecific rank, have been presented at various times to the Hope Collection at Oxford. The types in every case are in the Hope Collection.

1. **Teracolus rogersi,** sp. n. (Plate I, figs. 1–4.)

♂. Exp. al. 35 mm. *Upperside* creamy white; fore-wings with a deep orange apical patch, separated from the rest of the wing by a nearly straight narrow dark band with blurred edges; this band leaves the costa at a point just opposite the outer termination of the cell, and reaches the hind margin at the termination of the first branch of the median vein. Costa and hind margin with a black border, broadened from the termination of the third subcostal to that of the first median vein, elsewhere narrow. The veins within the apical orange patch are black, and the dark broadened border is prolonged inwardly upon them for a short distance. There is a minute black spot at the apex of the re-entrant angle at the outer end of the cell, and a small black patch at the base of the wing,

somewhat prolonged along the inner margin. Fringe darkish opposite the apical patch; elsewhere pale. Hind-wings narrowly bordered with black, a blackish patch at the marginal termination of each branch of the median, of the radial, and of the two subcostal veins, the latter three patches being more or less fused together. A minute blackish streak, representing a submarginal spot, near the border; running between, and parallel with, the third median and radial veins. Base of the wing with a blackish patch, rather larger and more diffused than that of the fore-wing. Fringe pale.

Underside. Fore-wings white; the apical area, which corresponds in size with that on the upper surface, divided into an outer ochreous and inner pale orange band by a series of four minute dusky spots, elongated in a direction parallel with the veins. Discoidal spot somewhat larger and more distinct than on the upper surface. Hind-wings reddish ochreous with a slight dusky clouding in the precostal space, along the posterior half of the cell, and between the median and submedian veins. A bright orange-yellow streak along the costa, and a submarginal series of six diffused dusky spots, each occupying one of the interspaces from the costal to the second median; of these the first (in the costal interspace) is the largest, and the third (in the second subcostal interspace) is almost obsolete. A small squared black spot at the re-entrant angle terminating the cell, bounded internally by a slight diffusion of orange-yellow.

♀. Exp. al. 36–39 mm. *Upperside* pale creamy white; fore-wings with an orange apical patch of nearly the same shade and relative size as in the male. This patch is separated from the rest of the wing by an irregular dark bar, narrow in the middle of its course, but expanding anteriorly into a triangular blotch with its base resting on the costa, and posteriorly becoming fused with a curved submarginal band of dark spots, increasing in size from before backwards, and traversing the middle of the orange patch from the second subcostal to the second median interspace. The costa as far as the apical patch is narrowly bordered with grey, the patch itself is bounded anteriorly and posteriorly with black, the black posterior margin being much thicker than in the male, and less markedly prolonged along the veins, but being similarly narrowed as it leaves the patch and approaches the anal angle. As in the male, the veins crossing the apical patch are black. The black discoidal spots are larger and more conspicuous than in the male; the base of the wings shows a greyish diffusion, and a well-marked dark grey bar runs in the median and submedian interspaces, parallel with the inner border, and ending near the anal angle in a fairly definite dark patch which appears to be in series with the submarginal spots. The fringes are pale reddish, taking a darker

tinge in the region of the apical patch. Hind-wings narrowly bordered with black, a marginal row of dark spots as in the male, the anterior three being fused into a marginal band; a submarginal series of dark spots occupying the interspaces, that in the radial interspace (between the radial and third median veins) being the largest and darkest. The base shows a greyish clouding, which is slightly prolonged towards the anal angle. A minute black discoidal spot present. Fringes pale reddish.

Underside. Fore-wings white; inner four-fifths of cell washed with pale lemon-yellow. Apical patch divided by a row of dark submarginal spots, corresponding to those on the upper side but more discrete, into an outer reddish-ochreous and inner orange-ochreous portion, the contrast between the two tints being much less marked than in the male. The black discoidal spot is not larger than on the upper surface. A pale greyish bar runs parallel with and close to the inner border, ending near the anal angle in a fairly definite dark patch. Hind-wings as in the male, but slightly darker and with a somewhat more pronounced dusky suffusion. The submarginal spots are much larger than in the male. The discoidal dot is very slightly touched with orange. There is an orange streak along the costa, and a pale Indian-red patch at the origin of the median vein.

In both sexes the row of submarginal spots in the median and submedian interspaces of the hind-wing (in the male visible only on the under surface) conforms more nearly to the curved margin of the wing than is usual in this group of *Teracolus*.

1 ♂, 3 ♀♀ (Taveta), in Hope Collection, Oxford. The male and one of the females were bred by the Rev. K. St. A. Rogers, emerging on August 6, 1905. A second female was captured on August 7, 1905, and a third female on July 16, 1910, both by Mr. Rogers.

The species may be an East African representative of *T. halyattes*, Butl., the type of which came from Natal. *T. halyattes* is regarded by Butler as the dry-season phase of his *Teracolus lais*, the type of which also came from South Africa. The representative of *T. lais* in the Nile district is doubtless *T. ephyia*, Klug, and the present form, intermediate between *T. lais* and *T. ephyia* in geographical position, is in some respects intermediate also in character. One feature that serves to distinguish it from the type of *T. halyattes* is that the submarginal series of spots on the hind-wing tends to form a curve more or less conformable to that of the wing-margin, whereas in *T. halyattes*, as gener-

ally in members of the *achine* group of *Teracolus*, the submarginal series of the hind-wing is sharply bent to a right angle at the level of the third median branch. In those specimens that I have examined, the males of *T. lais* and *T. rogersi* can be distinguished by their plume-scales. These are nearly of the same size in the two forms, but in *T. lais* the sides of the lamina proximally to the apex are almost parallel, whereas in *T. rogersi* they tend to converge towards the spring of the fimbriae. The plume-scales of *T. ephyia* have their sides usually parallel, as in *T. lais*, but they are smaller, and generally much narrower in proportion to their length.

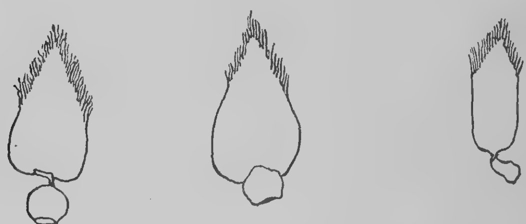


Fig. 1. *T. lais*, Butl. × 310. Fig. 2. *T. rogersi*, n.sp. × 310. Fig. 3. *T. ephyia*, Klug. × 310.

Scent-scales.

2. **Belenois victoria, sp. n.** (Plate II, figs. 5–8.)

♂. Exp. al. 55 mm. *Upperside* white; a slight greyish dusting close to the body. Costa of the fore-wing very narrowly edged with black. A black apical patch, continued as an irregular black border along the hind margin. The irregularity of the border is chiefly due to a marked projection inwards between the second and third median branches, the border at this point filling about the outer two-fifths of the interspace indicated. The marginal ends of the first median branch and of the submedian vein are marked by black spots, prolonged for a short distance inwards. The former of these spots is large, and fuses with the black border. The latter spot is smaller and may remain distinct, or may be connected with the dark border by an intermediate dusting of grey. At the outer end of the cell is a large roundish black spot, covering the second discocellular vein. This spot may be entirely isolated, or may be connected with the dark edging of the costa by a dusky curved band, more or

less developed, following the outer and anterior margin of the cell, and so having its concavity directed towards the root of the wing. Some or all of the interspaces between the veins which traverse the dark apex and hind border are marked by a powdering of white scales, generally very indistinct, but in the space between the fourth subcostal branch and the first radial vein assuming the appearance of a definite white spot. The hind-wing may be entirely immaculate, or may have the marginal ends of the veins marked with black points.

Underside. Fore-wing white; the costa slightly edged with greyish yellow. Apical patch, corresponding in extent with that of the upper surface, of the same greyish yellow, bordered inwardly with a slightly festooned streak of pale fawn-colour. A dark spot more or less developed, in the second median interspace, corresponds in position with the inward projection of the dark hind border above. The spot on the second discocellular vein corresponds with that on the upper surface, but is of a less intense black; there may or may not be a trace of the curved dusky band connecting it with the costa. In some specimens there is a slight yellow shade at the root of the wing.

The hind-wing is of a greyish yellow like the apex of the fore-wing. There is a streak of vivid orange along the whole length of the costa, broadest near the body, and reaching as far as the marginal end of the first subcostal branch; a short streak of the same colour occupies the root of the interspace between the median and submedian veins. The remaining marks are of the same pale fawn-colour as that bordering the apical patch of the fore-wing. They consist of a slight accentuation of the veins with their branches, broadening into a patch on the second discocellular, and including the vestigial vein between the median and submedian and that within the cell; including also a patch between the origins of the first and second median branches and another patch adjoining it internally; a series of submarginal spots in the interspaces, those from the second subcostal to the submedian vein taking an arrow-head form with the points directed inwards; and, finally, a series of linear spots at the marginal ends of the veins and their branches, parallel with the margin, and occasionally fused into a narrow marginal band.

♀. Exp. al. 53 mm. *Upperside.* Fore-wing white; hind-wing varies from white through primrose yellow to deep yellow ochre. Dark markings as in the male, but more pronounced. Fore-wing, costal edging broader, apical black continued along hind margin as far as anal angle; no separate marginal spots; no white dusting in interspaces; the black spot on the second discocellular joined to

the costa by a broad dusky band which may occupy the anterior half of the cell. Marginal spots of the hind-wing much larger than in the male.

Underside as in the male, but with a conspicuous orange flush at the base of the fore-wing, extending over the proximal two-thirds of the cell, and showing faintly through on the upper surface.

29 ♂♂, 4 ♀♀ (Tiriki, Victoria Nyanza; and Toro, W. Uganda), in the Hope Collection, Oxford.

Fourteen of the males and all four females were captured by Mr. C. A. Wiggins in the Tiriki Hills, N.E. of the Victoria Lake, during February and March 1903. Fifteen males (also presented by Mr. Wiggins) were taken by native collectors in the Toro country, on the eastern slopes of Ruwenzori, in November and December 1900. These are all recorded by Mr. S. A. Neave, under the head of *Belenois zochalia* f. *formosa*, Butl., in Novitat. Zoolog. vol. xi, 1904, p. 358.

This is a very distinct form of the *Belenois zochalia* group. It is easily distinguished from *crawshayi*, Butl., *tanganyikae*, Lanz (*formosa*, Butl.), and *diminuta*, Butl., by the darker apex and border of the fore-wing, from which the white spots have almost disappeared in the male and have entirely vanished in the female; the nearly immaculate white or yellow of the hind-wing; but especially by two features of the under surface, viz. the great prolongation of the orange costal streak, and the general character of the dark markings on the hind-wing. In the other forms of the *B. zochalia* group, these latter markings are linear, looking as if they had been drawn with a pencil or stiff brush. When they become faint or disappear, as in *B. diminuta*, they do so by attenuation and curtailment. In *B. victoria* they look as if they were made with a soft brush, and they become faint by gradually melting, without diminution of size, into the ground-colour of the wing.

In the National Collection there are three males of this form, two from Mount Elgon and one from Toro. They are ranked as *B. formosa*, but differ in the points stated from the type of *formosa* beside them.

Among the African forms of the genus *Nychitona*, Butl., (*Leptosia*, Auriv.), there is a race or subspecies first known to me by four specimens from the region of the Victoria Nyanza, presented to the Hope Collection by Mr. C. A. Wiggins. The series consists of two males from the Toro country on the eastern slopes of Ruwenzori, captured by natives in November or December 1900; and two females, one captured by Mr. Wiggins at Entebbe on the N.W. shore of the lake on April 8, 1903, and the other caught by a native in the Ugaia country, south of the Kavirondo gulf, in January 1903. These specimens differ in some respects from all forms of *Nychitona* hitherto described, but may be considered as a subspecies of *N. medusa*, Cram.

3. **Nychitona wigginsi,** subsp. n. (Plate III, figs. 9–12.)

♂. Exp. al. 46 mm. *Upperside* dead, opaque white, with a very faint greenish-yellow tinge; not semi-translucent as in some other forms of *Nychitona*. Fore-wings with slight fuscous mottling along the costa, reaching from the body to a point opposite the origin of the first branch of the subcostal. A dark fuscous apical crescentic patch, slightly waved on its inner aspect but not indented as in most other forms of *Nychitona*, beginning at a point on the costa nearly opposite the origin of the second subcostal branch, and ending on the hind margin in the interspace between the first and second median branches. Hind-wings bordered with a very narrow dark line, the centre of each interspace marked on the border by a minute dark spot. There is no other marking on the upper surface of either fore or hind-wing, but the mottling of the under surface shows faintly through.

Underside white; a dull green mottling filling the basal half of the cell, and prolonged on the costa as far as the termination of the first subcostal branch. A similar mottling on the apical area corresponds to the dark crescentic patch on the upper surface, and is also found over the whole of the hind-wing. This mottling of the hind-wing is scattered generally over the surface of the wing, and shows little or no tendency to fall into the parallel streaks which are conspicuous in some other forms of *Nychitona*.

♀. Closely resembles the male in size and aspect. In both sexes the tint and texture of the upper surface give an aspect which is conspicuously different from that of other forms of *Nychitona*.

The marked resemblance of this form to the curious *Leuceronia pharis*, Boisd., which also occurs in the Ugaia

country, and probably in the Toro district, was commented on by me in Trans. Ent. Soc. Lond., 1908, p. 569. I may here be allowed to mention that the statements there made had reference to the present form of *Nychitona* only, and not, as has been supposed, to other forms, such as that named *immaculata* by Aurivillius, more or less closely resembling it.

4. **Hesperocharis longstaffi**, subsp. n. (Plate II, figs. 1–4.)

♂. Exp. al. 52 mm. *Upperside.* Fore-wings very pale chrome yellow, passing gradually into pale ochreous at the apex. Fuscous scales form a very narrow edging to the costa, and are collected about the marginal terminations of the subcostal and median branches, and of both radial veins, appearing in this situation as a series of small ill-defined triangular spots, fused at the apex of the wing by their bases, and diminishing in size along the posterior border; a fuscous line, belonging partly to the fringe, extends from the apex to the termination of the first median branch. Hind-wing, pale ochreous like the apex of the fore-wing, becoming lighter towards the costa and deepening slightly towards the hind and inner margin. Anal angle somewhat prolonged.

Underside. Fore-wings dead white; apex pronounced yellow ochre. A very slight fuscous edging to the outer two-thirds of the costa, prolonged for a short distance round the apex. A small, ill-defined fuscous spot on the costa, just proximal to the origin of the second branch of the subcostal. Hind-wings, rich yellow ochre, deepening on the costa, which is narrowly edged with fuscous throughout its whole extent except a very small portion near the body. A series of four fuscous spots runs almost parallel with the costal and hind margin, the first two actually on the costa, the third barely touching it, and the fourth a little distance inwards from the hind border. These spots, which have a purplish tinge from contrast with the general yellow of the wing, are situated respectively on each side of the costal vein, in the interspace between the two branches of the subcostal, and in that between the lower subcostal and radial. The first two are the most intense in colour, the fourth distinctly fainter, the second and third are the largest. There is a

fifth spot, similar to the fourth of the preceding series, but smaller, just internal to the origin of the first median branch. The ventral part of the thorax shares in the rich ochreous colour of the hind-wings.

♀. Exp. al. 60 mm. (Another ♀ in Coll. Hope, 57 mm.) *Upperside* of both wings a bright canary yellow, somewhat deeper on the hind-wing and at the apex of the fore-wing. A narrow fuscous edging and apical spots as in the male. *Underside* as in the male except that the dead white of the fore-wing is replaced by canary yellow, and that the fuscous spots on the fore-wing and between the second subcostal and radial of the hind-wing may be absent.

In the male the fore-wing has a sharp apical angle, and the posterior margin is slightly concave. In the female the apex is more rounded, and the posterior margin is nearly straight. The hind-wing in the female has the anal angle slightly prolonged, but less so than in the male.

1 ♂, 2 ♀♀ (Venezuela), in Hope Collection, Oxford.

All three specimens were captured by Dr. G. B. Longstaff; the male and one female on January 9, 1913, at an altitude of about 1300 ft., below Zigzag Station, La Guaira, Venezuela; the second female on January 11, 1913, at about 1000 ft., between Curatici and Zigzag.

The present is the Venezuelan form of the group containing *H. jaliscana*, Schaus (Mexico), *H. lenoris*, Reak. (Mexico), *H. idiotica*, Butl., and *H. crocea*, Bates (Costa Rica). The earliest-named of the group appears to be *H. crocea*, which is probably indistinguishable from *H. lenoris*, as remarked by Godman and Salvin (Biol. Centr.-Amer., Rhopalocera, vol. ii, pp. 127–8). *H. idiotica* may be the same; the locality of the type is unknown.

H. longstaffi is distinguished from *H. crocea* by the absence of orange suffusion on the upper surface of the hind-wing; Dr. Longstaff's specimens differ from co-types of *H. jaliscana* by the deeper colour in both sexes, by the fainter development of the fuscous markings at the apex of the fore-wing, and by the much greater prominence of the dark costal spots on the under surface of the hind-wing.

A male Pieris was captured by Dr. G. B. Longstaff, at an elevation of about 1300 ft., between Zigzag Station and the port of La Guaira, Venezuela, on March 29, 1907. This capture is recorded in his book, "Butterfly Hunting in Many Lands," 1912, p. 320, and the specimen is well figured on Plate III, figs. 1, 2 of the same volume. At the same place, on January 11, 1913, Dr. Longstaff caught, together with specimens which appear to be referable to *P. sevata*, Feld., a female Pierine which I believe to be conspecific with the male above mentioned. These two specimens were referred to by me in Proc. Ent. Soc. Lond., 1913, pp. cxiii, cxiv, and are here described under the name of *Pieris janeta*.

5. **Pieris janeta,** sp. n. (Plate II, figs. 5, 6.)

♂. Exp. al. 62 mm. *Upperside* white with a slight but distinct greenish tinge. A slight fuscous edging to the costal and posterior margin, expanding somewhat at the apex, and prolonged nearly to the anal angle. A somewhat paler fuscous streak fills the space between the costa and costal vein for about two-thirds of the distance from base to apex. Fore-wing otherwise immaculate. Conspicuous streaks of roughened texture, dead white in colour, accompanying both sides of the submedian vein, of the median trunk from the origin of its first branch to that of its third, and of the median branches themselves. They are also found on both sides of the lower, and on the inner, or posterior, side of the upper radial and of that part of the subcostal trunk from which the upper radial originates, on the outer side of the two discocellular veins, and finally as a small patch in the upper and distal angle of the cell. The streaks generally fuse together at the root of each interspace, but in the interspace between median and submedian they remain distinct, neither streak reaching inwards as far as the median trunk. Hind-wing immaculate; roughened streaks like those on the fore-wing accompanying the subcostal and median veins. Third branch of subcostal in fore-wing very short.

Underside: fore-wings generally dull white; dead white where the roughened streaks show through from the upper surface. Apex and costa pale ochreous. Hind-wings uniformly ochreous, of a somewhat deeper shade than the apex of the fore-wing; a fuscous spot, like that in the female, occupying the angle between the lower discocellular and third branch of the median vein. The costa thinly edged with bright yellow; a minute spot of the same at the root of the subcostal vein.

♀. Exp. al. 60 mm. *Upperside* dull creamy white; not tinged with greenish, as in the male. Fore-wing with a fuscous shade along the costa, filling the space between the costa and the subcostal vein at the base, and for rather more than half the length of the cell. This shade is continued distally as a narrowing line along the costa as far as the apex, where it fuses with a fuscous apical patch, small in extent and prolonged as a narrow tapering band along the posterior margin as far as the first branch of the median vein. A few fuscous scales on the lower discocellular vein. Hind-wing

FIG. 4.
P. janeta, n. sp. × 120.

FIG. 5.
P. sevata, Feld. × 120.

SCENT-SCALES.

immaculate. Anal angle slightly prolonged. The third branch of the subcostal in the fore-wing appears to be absent.

Underside: fore-wing dull white, apex and costa pale greyish ochreous. Hind-wing pale ochreous with a slight pinkish shade; a fuscous spot 1–2 mm. in diameter, close to the lower discocellular vein, in the interspace between the third median branch and the radial. The costa edged with deep yellow; a minute spot of the same at the root of the subcostal vein.

The male of *P. janeta* is easily distinguishable from the male of *P. sevata* by the character and distribution of the scent-scales. These in *P. janeta* are on an average more than half as long again as in *P. sevata*. Moreover, in *P. sevata* the mealy streaks formed by these scales fuse along the

inner or posterior side of the median vein proximally to the origin of the first median branch; in *P. janeta* the area indicated is free from scent-scales (*see* Proc. Ent. Soc. Lond., *loc. cit.*, where "submedian" should be read for "internal").

P. janeta may perhaps be a subspecies of *P. sincera*, described by Weymer (Reiss und Stübel, Reisen in Sud.-Amerika, 1890, p. 123; Taf. III, fig. 19), from a male specimen captured on the sea-level at Guayaquil, Ecuador. But it differs in several particulars from Weymer's figure and description.

6. **Pieris howarthi,** sp. n. (Plate II, figs. 7–10.)

♂. Exp. al. 58 mm. *Upperside* dull white very slightly tinged with green. Fore-wing with pale fuscous spots on the apex and along the hind-margin, at the extremities of the branches of the subcostal (except the first), of the two radials and of the branches of the median; the first and last of these spots being represented only by a few fuscous scales. A conspicuous dark fuscous spot on the lower discocellular. Conspicuous streaks of roughened texture, dead white in colour, accompanying both sides of the first and second median branches and of the submedian vein; also the inner side of the third median and of the median trunk from the origin of the first branch to that of the third. Beneath, the fore-wing is dull white, the apical region pale fuscous. The discocellular spot is larger than on the upper surface, and of a less deep fuscous shade. The roughened areas of the upper surface show through as dead white streaks. There are traces of a pale fuscous discal spot on each side of the third median, and above the second median, in each case about half-way between the cell and the margin of the wing.

The hind-wing is immaculate above, and shows no roughened streaks. Beneath, it is of a pale yellow ochre, plentifully besprinkled with pale fuscous scales like those of the fore-wing. These are more closely set in some places than in others, forming a brownish shade over the base of the wing; this shade occupies most of the space between the costal and first subcostal branches, a quarter or more of the subcostal interspace, and nearly the whole of the cell, stopping just short of the lower discocellular. Outside the cell it accom-

panies the inner side of the median trunk and first median branch, but leaves free the greater part of the course of the submedian vein. In the angle between the median trunk and the first median branch, it passes into a curved band which takes its course round the end of the cell, turns forward, and becomes lost on the lower aspect of the second subcostal. The fuscous shade is somewhat deeper just anteriorly to the third median branch than elsewhere, but it does not form a definite spot. A much paler fuscous infusion forms a broad marginal shading to the wing. There is a minute dark fuscous spot on the lower discocellular, close to the origin of the radial; the costa is edged with rich orange, prolonged along the margin as a narrowing streak as far as the end of the first subcostal. A spot of the same colour occupies the root of the subcostal at its junction with the body.

♀. Exp. al. 52 mm. (Another ♀ measures 54 mm.) *Upperside* white tinged with greenish yellow. Fore-wing with a slight duskiness along the costa, which opposite the end of the cell passes into a definite dark streak reaching to the apex. The extremities of the veins along the hind margin marked, as in the male, with fuscous spots; these diminish from before backwards; no spot on the submedian vein. A dark fuscous spot, larger than in the male, occupies nearly the whole of the lower discocellular vein; and dark discal spots, similar in character and situation to those on the lower surface in the male, but more pronounced, occur in connection with the second and third median branches. The series is continued by another smaller spot internal to the first median branch. Hind-wing immaculate except for a minute dark spot on the lower discocellular vein.

Beneath, the fore-wings are white, tinged with the same greenish yellow as on the upper surface; but even paler, especially towards the inner margin. The apical area is ochre yellow dusted with yellowish brown. The same brownish dusting is continued inwardly as an ill-defined streak along the costa, but dies out before reaching the body. Within the apical area it collects chiefly at the marginal ends of the veins, forming indistinct spots which are prolonged as a diminishing series as far as the termination of the first median. A further condensation of brownish or fuscous scales forms a patch at the inner end of the apical area where this meets the costa. This patch is in series with dark discal spots occupying corresponding situations with those on the upper surface; the last of them is marked only by a few brown scales. A dark oval spot, larger than the corresponding spot on the upper surface, occupies the lower discocellular vein. The ground-colour of the hind-wings is the same as that of the apical area of the fore-wings, viz.

yellow ochre. Like the latter area it is plentifully dusted over with yellowish brown scales. These form a deep shade over the basal half of the wing, terminating distally by a curved edge running nearly parallel with the wing-margin, and leaving a small area of the yellow ground-colour at and beyond the end of the cell. Broad rays of a paler shade of yellowish brown accompany the distal portions of the veins as they traverse the yellow marginal area. The veins themselves, with their branches, share in the ochre yellow of the ground-colour. There is a conspicuous dark brown spot, larger

FIG. 6.
P. howarthi, n. sp. × 120.

FIG. 7.
P. josepha, Godm. & Salv. × 120.

SCENT-SCALES.

than that of the upper surface, on the lower discocellular vein, close to the origin of the radial. The costa is edged with rich orange, and the same colour is prolonged round the base of the wing as far as the origin of the subcostal vein.

The third subcostal branch of the fore-wing is present in a rudimentary form on the right side of the male type and both sides of the female type. It appears to be absent from the left side of the male type, and from both sides of another female in the Hope Collection.

1 ♂, 2 ♀♀ in Hope Collection, Oxford. These were captured on the sea-level, at Tembabichi Bay, Lower

H. Knight del. West, Newman chr.

NEW FORMS OF PIERINAE.

Explanation of Plate I.

Fig. 1.	*Teracolus rogersi*,	n. sp.,	♂,		Taveta.
2.	,,	,,	,,	underside,	,,
3.	,,	,,	♀,		,,
4.	,,	,,	,,	underside,	,,
5.	*Belenois victoria*,	,,	♂,		Tiriki.
6.	,,	,,	,,	underside,	,,
7.	,,	,,	♀,		,,
8.	,,	,,	,,	underside,	,,
9.	*Nychitona wigginsi*,	n. subsp.,	♂,		Toro.
10.	,,	,,	,,	underside,	,,
11.	,,	,,	♀,		Entebbe.
12.	,,	,,	,,	underside,	,,

Note.—Fig. 2. The type has two minute subapical spots not shown in the figure; in the hind-wing the relative size of the first and second submarginal spots should be reversed, and the spot nearest the anal angle should be omitted.

Figs. 2 and 4. The discocellular spot in the hind-wing of each type is touched proximally with orange.

Fig. 6. The costal orange streak in the type is not prolonged beyond the termination of the first subcostal branch.

Fig. 8. The marginal spots of the hind-wing are in the type of the same colour as the remaining spots of the hind-wing.

Explanation of Plate II.

Fig. 1.	*Hesperocharis longstaffi*,	n. subsp.,	♂,		Venezuela.
2.	,, ,,	,,	,,	underside,	,,
3.	,, ,,	,,	♀,		,,
4.	,, ,,	,,	,,	underside,	,,
5.	*Pieris janeta*,	n. sp.,	♂,		,,
6.	,,	,,	♀,		,,
7.	*Pieris howarthi*,	,,	♂,		Lower California.
8.	,,	,,	,,	underside,	,,
9.	,,	,,	♀,		,,
10.	,,	,,	,,	underside,	,,

Note.—Fig. 2. A small fuscous spot on the costa of the fore-wing, present in the type, is not shown in the figure.

Fig. 5. A minute yellow spot at the root of the subcostal vein in the hind-wing underside is omitted from the figure.

H. Knight del. West, Newman chr.

NEW FORMS OF PIERINAE.

California, Lat. 26° 5 N., by Mr. Osbert H. Howarth, so long ago as March 21, 1898. They have hitherto remained undescribed, but were mentioned by me in Proc. Ent. Soc. Lond., 1913, p. cxiv.

P. howarthi belongs to the same section of *Pieris* as the preceding species. Its nearest relatives are *P. josepha*, Godm. & Salv., *P. josephina*, Godt., and *P. amaryllis*, Fabr. (Central America and West Indian Islands). It is quite distinct from all of these, being much smaller, and differing markedly on the underside. It resembles *P. josepha* and *P. josephina* in the character of its plume-scales, which are some of the longest known to me in the whole sub-family of Pierines.

Note.—Owing to a prolonged absence from England, the author was unable to superintend the printing of the Plates which have been prepared from Mr. H. Knight's admirable drawings. A few very slight inaccuracies have resulted, attention to which is called at the foot of the Explanation of each Plate.

Explanation of Plates I, II.

[*See Explanation facing the* Plates.]

[*From the* PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON, 1916.]

[Published March 1916.]

On a Collection of Moths made in Somaliland by Mr. W. Feather. By Professor E. B. POULTON, M.A., F.R.S., F.Z.S. With Descriptions of New Species, by Sir G. F. HAMPSON, Bart., L. B. PROUT, J. H. DURRANT, and Dr. KARL JORDAN.

(Plates I. & II.*)

INDEX.

The moths described in the following pages were very carefully collected by Mr. Walter Feather, who preserved excellent data. Sir George Hampson has described the new species of all the groups except the Sphingidæ, by Dr. Karl Jordan, the Geometridæ, by Mr. L. B. Prout, and the Tineina, by Mr. J. H. Durrant. The order of the species is from the more specialised to the more generalised except in the Geometridæ, which Mr. Prout has arranged in the opposite sequence.

Types of the species described by Sir George Hampson and Mr. Durrant are in the collection of the British Museum, co-types, when the series permits, in the Hope Department, Oxford University Museum, and Mr. Feather's collection. Dr. Jordan's and Mr. Prout's types are in the Hope Collection, co-types, when the series permits, in the British Museum, Mr. Feather's collection, and that of the describer. This statement renders unnecessary any further reference to the disposition of types and co-types in the descriptive part of this memoir.

* For explanation of the Plates, see pp. 181-2.

The numbers prefixed to the names of species in the first part of the memoir are those of Hampson's 'Catalogue of Lepidoptera Phalænæ in the British Museum,' the position of new species being indicated by letters added to the numbers of the most closely allied species in the Catalogue. Thus species 2094*a* would immediately follow 2094 in the Arctianæ of the Catalogue.

The specimens were collected at the following localities, of which the descriptions have been kindly furnished by Mr. Feather:—

MANDERA.

Forty-seven miles south-west of Berbera, alt. 3000 ft.

Rocks, grey and red granite.

Open and bush country, bush being mainly made up of thorny trees, nearly all flat-topped Acacias or Mimosa. Big areas covered with fibre-plants (*Sanseveria ehrenbergi*).

GAN LIBBAH.

(The "Lion's Paw.")

In the Golis Mts., seven miles east of Mandera, alt. 5800 ft.

Rock, limestone (Jurassic).

Good patches of big trees, mainly Juniper; also Euphorbias.

Good grass land with scarcely any thorn-bush.

BUGGAN.

Ten miles south of Mandera, alt. 3500 ft.

Rock, granite.

Thorn country, fairly open: few big wild Fig-trees.

HARGAISA.

One hundred and twenty miles south-west of Berbera, alt. 4000 ft.

Bush and trees same as Mandera, but a little denser. Bigger areas of *Sanseveria ehrenbergi*.

BERBERA.

All the moths I captured at Berbera were taken in the Bungalow at light. This was close to the sea; the maritime plain is very thinly covered with a low-growing thorn-bush.

Rock, coralline limestone.

DURBAR.

Nine miles south of Berbera, alt. 400 ft.

Rock, limestone.

Open land, few Palms with some rough grass.

Durbar is really the waterworks for Berbera, and at one time there was a poor sort of Government garden there.

With few exceptions the specimens were captured at Mandera, and this place is to be understood when no locality is mentioned in the text. Mandera is, however, always quoted for those comparatively few species which were also taken elsewhere. The specimens from Hargaisa dated Oct. 1908 were taken during a period of about two or three weeks by Captain Jorkinson.

Mr. Feather writes concerning the method of capture:—"I may say that all the moths were collected at light. I only remember taking one species—I think a Geometer—otherwise, and that I got in a porcupine-burrow along with a Skipper. I sugared many times, but the only insects that came were ants, and they completely covered the sugar."

Mr. L. B. Prout, in the introduction to the Geometridæ (p. 142), draws attention to the remarkable preponderance of females; and the same unusual condition is to be found again and again throughout the rest of the collection. Observations made Sept. 12–15, 1915, in Bombay Harbour, on the return from the visit of the British Association to Australia, have led me to believe that nocturnal flights of female Lepidoptera tend to occur during wet weather. The Bombay species included the females of certain butterflies which flew at night and came to light with the moths. The fact seems to be very interesting and well worthy of a separate communication dealing with these Somaliland moths and my own experience in Bombay. In order to test the relationship of female preponderance to wet weather, I have asked Mr. Feather to supply a record of the rainfall and temperature at Mandera. He kindly replied as follows:—

"I am enclosing the record of rainfall for Mandera, and have used much the same words as I wrote in my diary. My impressions of the rainfall were guided by what I had been used to in England, as this was my first visit to Africa.

"I cannot give you the amount of rain, as we had no rain-gauge. I should say the annual rainfall at Mandera is about 10–12 inches. Wet nights are a great rarity, the rain oftenest coming in short heavy showers in the morning or afternoon.

"The river I mention is, of course, a dry river-bed, except just after rain. The longest time that I remember water running down the channel was for about 8 hours. The river-bed is about 120 yards wide, and in one part was a very small stream of permanent water, which appeared between some rocks and ran on the surface for 20–30 yards before disappearing in the sand."

Record of Rain at Mandera, Somaliland, from Nov. 14th, 1907, to June 23rd, 1909, and of Temperatures, taken in the shade, from March 14th, 1908, to June 30th, 1909.

Date.	Morning and afternoon temperature (Fahrenheit).				Rainfall.
Nov. 14, 1907.	....				Rain in morning.
— 15, —	....				Rain in afternoon.
Jan. 22, 1908.	....				Fine drizzle all day.
Mar. 14, —	6.30 A.M.	65 deg.	1.30 P.M.	102 deg.	
— 15, —	— —	68 —	2.0 —	103 —	
— 16, —	6.0 —	63 —	— —	105 —	
— 17, —	6.30 —	66 —	1.0 —	104 —	
— 18, —	— —	65 —	1.30 —	104 —	
— 19, —	6.0 —	68 —	— —	105 —	
— 20, —	6.30 —	68 —	12.30 —	100 —	
— 21, —	— —	70 —	2.0 —	106 —	
— 22, —	— —	63 —	2.30 —	108 —	
— 23, —	— —	70 —			
— 24, —	6.0 —	68 —	2.30 —	98 —	
April 1, —	— —	70 —			
— 2, —	— —	67 —	12.30 —	93 —	
— 3, —	— —	68 —			
— 4, —	— —	69 —			
— 7, —	— —	70 —	1.0 —	90 —	
— 8, —	— —	75 —			
— 9, —	— —	68 —			
— 10, —	— —	68 —	1.0 —	78 —	Dull day: a few drops of rain.
— 11, —	— —	68 —	— —	85 —	
— 12, —	— —	64 —	— —	84 —	
— 13, —	— —	59 —			
— 14, —	— —	64 —	2.0 —	81 —	
— 15, —	— —	59 —	1.30 —	85 —	
— 16, —	— —	61 —	1.0 —	88 —	
— 17, —			2.0 —	96 —	
— 18, —	— —	66 —	— —	96 —	
— 19, —	— —	77 —	— —	97 —	
— 20, —	— —	80 —	— —	86 —	Slight shower in morning.
— 21, —	5.30 —	75 —	1.0 —	93 —	Heavy shower.
— 22, —	— —	71 —	1.30 —	86 —	
— 23, —	— —	69 —	2.0 —	79 —	Heavy rain for 1½ hrs.
— 24, —	6.0 —	70 —	1.30 —	81 —	Rain for 2 hrs.
— 25, —	— —	73 —	2.0 —	96 —	
— 26, —	— —	73 —	— —	93 —	
— 27, —	— —	73 —	1.0 —	95 —	
— 28, —	— —	77 —	2.0 —	95 —	
— 29, —	5.30 —	77 —	— —	96 —	
— 30, —	6.0 —	77 —	— —	87 —	
May 1, —	— —	75 —	— —	84 —	
— 2, —	— —	71 —	— —	90 —	
— 3, —			— —	93 —	
— 4, —	5.30 —	78 —	12.30 —	93 —	Slight shower.
— 5, —	6.0 —	78 —	2.0 —	95 —	Slight shower.
— 6, —	— —	78 —	— —	93 —	A short shower a little before sunset. During the shower hail-stones ¼ in. to ¾ in. in diameter fell.
— 7, —	— —	74 —	— —	84 —	
— 8, —	— —	72 —	— —	93 —	
— 9, —	— —	70 —			
— 10, —	— —	75 —	— —	84 —	

Date.	Morning and afternoon temperature (Fahrenheit).	Rainfall.
May 12, 1908.	5.30 A.M. 73 deg. 1.30 P.M. 94 deg.	
— 13, —	— — 74 — — — 94 —	Short shower.
— 14, —	6.0 — 75 — 2.0 — 94 —	Heavy shower in afternoon for 1½ hrs.; hailstones.
— 15, —	— — 75 — — — 93 —	
— 16, —	— — 76 — — — 84 —	Slight shower.
— 17, —	— — 70 — 1.30 — 69 —	Fairly heavy shower. Temperature fell considerably.
— 18, —	— — 66 — — — 84 —	
— 19, —	— — 65 — — — 84 —	
— 20, —	— — 75 — — — 91 —	
— 21, —	— — 71 — — — 91 —	
— 22, —	— — 68 — — — 91 —	
— 23, —	— — 68 — — — 94 —	
— 24, —	— — 75 — — — 94 —	
— 25, —	— — 74 — 1.0 — 94 —	
— 26, —	— — 73 — — — 94 —	
— 27, —	— — 75 — 1.30 — 93 —	
— 28, —	— — 65 — — — 91 —	
— 29, —	— — 77 — — — 91 —	
— 30, —	— — 79 — — — 93 —	
— 31, —	— — 75 — 2.0 — 95 —	
June 1, —	— — 76 — — — 95 —	
— 2, —	— — 76 — 1.30 — 94 —	
— 3, —	— — 78 — — — 94 —	
— 4, —	— — 77 — — — 92 —	
— 5, —	— — 75 — — — 92 —	A good heavy shower, starting at 3 P.M. and lasting till 5 P.M.; water coming down the river in fair quantity.
— 6, —	— — 75 — 2.0 — 88 —	
— 7, —	— — 74 — — — 91 —	
— 8, —	— — 76 — — — 93 —	
— 9, —	— — 75 — — — 96 —	
— 10, —	— — 77 — — — 95 —	
— 11, —	— — 75 — — — 93 —	
— 12, —	— — 74 — — — 92 —	
— 13, —	— — 73 — — — 93 —	
— 15, —	— — 73 — — — 95 —	
— 16, —	— — 75 — — — 94 —	
— 17, —	— — 78 — — — 94 —	
— 18, —	— — 78 — — — 94 —	Rain-storms all round, but none at Mandera.
— 19*, —	— — 78 — — — 94 —	
— 29, —	— — 75 — — — 102 —	Water came down river last night. Evidently heavy rain in the hills, though none at Mandera.
— 30, —	— — 73 — — — 101 —	
July 1, —	— — 79 — — — 102 —	
— 2, —	— — 75 — — — 103 —	
— 3, —	— — 78 — — — 98 —	
— 4, —	— — 78 — — — 101 —	
— 5, —	— — 100 —	Heavy shower; water coming down river.
— 6, —	— — 75 — — — 100 —	
— 7, —	— — 77 — — — 100 —	
— 8, —	— — 77 — — — 103 —	

* Here I have a note that I took the thermometer from the inside of the messhouse and hung it on the veranda (well in the shade). The temperature then immediately rose to 103 deg.

Date.	Morning and afternoon temperature (Fahrenheit).		Rainfall.
July 9, 1908.	6.0 A.M. 78 deg.	1.30 P.M. 101 deg.	
— 10, —	— — 77 —	2.0 — 101 —	
— 11, —	— — 76 —	— — 101 —	
— 12, —		— — 101 —	
— 13, —	— — 76 —	— — 102 —	
— 14, —	— — 77 —	— — 102 —	
— 15, —	— — 77 —	— — 102 —	
— 16, —	— — 78 —	— — 102 —	
— 17, —	— — 77 —	— — 100 —	
— 18, —	— — 75 —	— — 102 —	
— 19, —	— — 77 —		
— 20, —	— — 77 —	— — 99 —	
— 21, —	— — 75 —	— — 98 —	
— 22, —	— — 75 —	— — 99 —	
— 23, —	— — 78 —	3.0 — 98 —	
— 24, —	— — 78 —	2.0 — 98 —	
— 25, —	— — 78 —	— — 98 —	
— 26, —		— — 100 —	
— 27, —	— — 73 —	— — 95 —	
— 28, —	— — 76 —	— — 98 —	
— 29, —	— — 70 —	— — 95 —	
— 30, —	— — 70 —	— — 93 —	Had two rather dull days.
— 31, —	— — 75 —	— — 97 —	A good shower this evening.
Aug. 1, —	— — 75 —	— — 92 —	
— 2, —	— — 75 —	— — 87 —	
— 3, —	— — 73 —	— — 92 —	
— 4, —	— — 77 —	— — 97 —	
— 5, —	— — 78 —	— — 100 —	
— 6, —	— — 78 —	2.30 — 101 —	
— 7, —	— — 75 —	— — 90 —	
— 8, —	— — 70 —	2.0 — 92 —	
— 9, —	— — 73 —	2.30 — 93 —	
— 10, —	— — 76 —	2.0 — 97 —	
— 11, —	— — 71 —	— — 92 —	
— 12, —	— — 78 —	2.30 — 100 —	
— 13, —	— — 76 —	2.0 — 98 —	
— 14, —	— — 77 —	2.30 — 99 —	
— 15, —	— — 76 —	— — 101 —	
— 16, —		2.0 — 101 —	
— 17, —	— — 79 —	2.0 — 101 —	
— 18, —	— — 80 —	— — 103 —	
— 19, —	— — 79 —	— — 101 —	
— 20, —	6.30 — 79 —	— — 103 —	
— 21, —	6.0 — 80 —	— — 101 —	
— 22, —	— — 79 —	— — 101 —	
— 23, —	....	....	A shower this evening.
— 24, —	— — 75 —	2.30 — 98 —	
— 25, —	— — 77 —	— — 100 —	
— 26, —	— — 77 —	— — 103 —	
— 27, —	— — 78 —	2.0 — 100 —	
— 28, —	6.30 — 77 —	2.30 — 100 —	
— 29, —	— — 75 —	2.0 — 98 —	
[— 31, —	Berbera.—Temp. in Bungalow, 116 deg.]		
Sept. 3, —	6.0 A.M. 76 deg.	2.0 P.M. 98 deg.	
— 4, —	6.30 — 77 —	2.30 — 98 —	
— 5, —	6.0 — 75 —	— — 99 —	
— 6, —	— — 73 —	— — 95 —	
— 7, —	— — 74 —	— — 94 —	
— 8, —	6.30 — 77 —	— — 97 —	
— 9, —	6.0 — 77 —	2.0 — 99 —	
— 10, —	— — 75 —	2.30 — 102 —	

Date.	Morning and afternoon temperature (Fahrenheit).				Rainfall.
Sept. 11, 1908.	6.30 A.M.	75 deg.	2.30 P.M.	102 deg.	
— 12, —			3.0 —	104 —	
— 13, —	7.0 —	79 —	— —	101 —	
— 14, —	6.0 —	75 —	3.30 —	95 —	
— 15, —	7.0 —	77 —	2.30 —	101 —	
— 16, —	6.30 —	78 —	— —	96 —	
— 17, —	— —	75 —	1.30 —	98 —	
— 18, —	— —	76 —	2.30 —	96 —	
— 19, —	6.0 —	77 —	2.0 —	87 —	
— 20, —	— —	72 —	— —	95 —	Rain around, but only a few drops here: Mandera often seems to miss the rain.
— 21, —	— —	75 —	— —	95 —	
— 22, —	— —	76 —	2.30 —	99 —	
— 23, —	— —	76 —	— —	99 —	
— 24, —	— —	74 —	2.0 —	96 —	A few drops of rain at noon.
— 25, —	— —	75 —	— —	95 —	A good heavy shower, lasting about 20 mins.
— 26, —	5.30 —	73 —	2.30 —	94 —	
— 27, —	6.0 —	73 —	1.30 —	94 —	
— 28, —	— —	74 —	— —	89 —	
— 29, —	— —	74 —	— —	95 —	
— 30, —	— —	75 —	— —	90 —	A very slight shower at night. A good shower lasting 15 mins. this day. The last few days have been cloudy in early morning and late afternoon.
Oct. 1, —	— —	74 —	— —	90 —	
— 2, —	— —	72 —	2.0 —	92 —	
— 3, —	— —	75 —	1.30 —	92 —	
— 4, —	— —	75 —	2.0 —	92 —	
— 5, —	— —	73 —	1.30 —	90 —	
— 6, —	— —	72 —	— —	90 —	Heavy shower for 10 mins.
— 7, —	— —	69 —	— —	88 —	Slight shower in afternoon.
— 8, —	— —	68 —	2.0 —	88 —	
— 9, —	— —	72 —	— —	90 —	
— 10, —	6.30 —	66 —	— —	89 —	
— 11, —	6.0 —	67 —	— —	92 —	
— 12, —	6.15 —	65 —	1.30 —	94 —	
— 13, —	6.0 —	75 —	2.0 —	80 —	A few drops of rain.
— 14, —	— —	65 —	1.30 —	86 —	Water down river in quantity, but no rain at Mandera.
— 15, —	— —	63 —	— —	87 —	
— 16, —	— —	67 —	2.0 —	87 —	
— 17, —	— —	64 —	1.30 —	87 —	
— 18, —	— —	65 —	— —	87 —	
— 19, —	— —	63 —	2.0 —	85 —	
— 20, —	— —	65 —	— —	83 —	
— 21, —	6.30 —	59 —	— —	85 —	
— 22, —	— —	61 —	— —	83 —	
— 23, —	6.0 —	65 —	— —	83 —	
— 24, —	— —	59 —	— —	83 —	
— 25, —	— —	61 —	2.0 —	80 —	
— 26, —	— —	60 —	— —	78 —	A few drops of rain at night.
— 27, —	— —	66 —	— —	77 —	Slight shower in morning.
— 28, —	— —	68 —	— —	83 —	
— 29, —	— —	58 —	— —	87 —	
— 30, —	— —	61 —	— —	88 —	
— 31, —	— —	60 —	— —	89 —	
Nov. 1, —	— —	61 —	— —	88 —	
— 2, —	— —	68 —	— —	80 —	A good shower.
— 3, —	— —	66 —	1.30 —	76 —	
— 4, —	— —	68 —	— —	82 —	
[— 9, —	Gan Libbah.—Few drops of rain.]				

Date.	Morning and afternoon temperature (Fahrenheit).				Rainfall.
[Nov. 10, 1908.	Gan Libbah.—Rain for 2 hrs.]				
— 12, —	6.0 A.M.	62 deg.			
— 13, —	— —	61 —	2.0 P.M.	82 deg.	
— 14, —			2.30 —	78 —	
— 15, —	— —	59 —	2.0 —	80 —	
— 16, —	— —	59 —	— —	80 —	
— 17, —	— —	56 —	1.30 —	82 —	
— 18, —	— —	60 —	— —	80 —	
— 19, —	— —	59 —	— —	80 —	
— 20, —	— —	59 —	— —	80 —	
— 21, —	— —	57 —			
— 22, —	— —	53 —			
— 23, —	— —	56 —			
— 24, —	— —	53 —	1.30 —	85 —	
— 25, —	— —	50 —	3.30 —	82 —	
— 26, —	— —	55 —	2.30 —	78 —	
— 27, —	— —	48 —	2.30 —	74 —	
— 28, —	— —	55 —			
[— 29, —	Berbera.				A few drops.]
Dec. 21, —	— —	51 —	2.0 —	72 —	
— 25, —	— —	55 —	3.0 —	70 —	
— 26, —	— —	53 —	— —	75 —	
— 27, —	6.30 —	48 —	2.0 —	75 —	
— 28, —	6.0 —	51 —	1.0 —	75 —	
— 29, —	— —	57 —	1.30 —	73 —	
— 30, —	— —	53 —	— —	73 —	
— 31, —	— —	54 —	1.0 —	73 —	
Jan. 1, 1909.	— —	52 —	— —	72 —	
— 2, —	— —	51 —	— —	73 —	
— 3, —	— —	49 —	— —	72 —	
— 4, —	— —	53 —	— —	70 —	
— 5, —	— —	51			
— 11, —	— —	60 —	— —	72 —	Fairly heavy dews for the last [4 weeks.
— 12, —	— —	55 —	— —	73 —	
— 13, —	— —	50 —	2.0 —	75 —	
— 14, —	— —	53 —	— —	81 —	
— 15, —	— —	55 —	1.30 —	80 —	
— 16, —	— —	60 —	— —	81 —	
— 17, —	— —	58 —	2.0 —	83 —	
— 18, —	— —	60 —	1.30 —	80 —	
— 19, —	— —	60 —	— —	80 —	
— 20, —	— —	61 —	— —	81 —	
— 21, —	— —	63 —	2.0 —	86 —	
— 22, —	— —	60 —	1.30 —	78 —	
— 23, —	— —	63 —	1.30 —	73 —	A few drops.
— 24, —	— —	60 —	2.0 —	75 —	
— 25, —	— —	60 —	1.30 —	78 —	
— 26, —	— —	60 —	— —	77 —	
— 27, —	— —	58 —	— —	76 —	
— 28, —	— —	53 —	2.0 —	70 —	
— 29, —	— —	50 —	1.0 —	70 —	
— 30, —	— —	50 —	1.30 —	75 —	
— 31, —	— —	51 —	— —	77 —	
Feb. 1, —	— —	52 —	— —	80 —	
— 2, —	— —	55 —	— —	80 —	
— 3, —	— —	55 —	— —	75 —	
— 4, —	— —	60 —	— —	75 —	
— 5, —	— —	60 —	— —	77 —	
— 6, —	— —	61 —	— —	76 —	
— 7, —	— —	60 —	2.0 —	74 —	
— 8, —	— —	57 —	— —	75 —	

Date.	Morning and afternoon temperature (Fahrenheit).		Rainfall.
Feb. 9, 1909.	6.0 A.M. 55 deg.	2.0 P.M. 73 deg.	
— 10, —	— — 56 —	— — 73 —	
— 11, —	— — 58 —	1.30 — 85 —	
— 12, —	— — 57 —	— — 75 —	
— 13, —	— — 58 —	— — 79 —	
— 14, —	— — 59 —	2.0 — 79 —	
— 15, —	— — 58 —	1.30 — 79 —	
— 16, —	— — 55 —	1.0 — 81 —	
— 17, —	— — 54 —	— — 85 —	
— 18, —	— — 59 —	1.30 — 81 —	
— 19, —	— — 60 —	— — 84 —	
— 20, —	— — 60 —	— — 81 —	
— 21, —	— — 61 —	2.0 — 78 —	
— 22, —	— — 61 —	— — 80 —	
— 23, —	— — 56 —	1.30 — 83 —	
— 24, —	— — 56 —		
— 25, —	— — 57 —	— — 83 —	
— 26, —	— — 60 —	— — 81 —	
— 27, —	— — 57 —	— — 83 —	
— 28, —	— — 57 —	— — 81 —	
Mar. 1, —	— — 57 —	1.0 — 85 —	
— 2, —	— — 60 —	1.30 — 81 —	
— 3, —	— — 56 —	1.0 — 75 —	
— 4, —	— — 58 —	— — 79 —	
— 5, —	— — 59 —	1.30 — 81 —	
— 6, —	— — 59 —	— — 80 —	
— 7, —	— — 61 —	1.0 — 76 —	
— 8, —	— — 61 —		
— 9, —	— — 58 —	1.30 — 80 —	
— 10, —	— — 60 —	— — 78 —	
— 11, —	— — 59 —	— — 79 —	
— 12, —	— — 58 —	— — 80 —	
— 13, —	— — 58 —	— — 82 —	
— 14, —	— — 57 —	— — 81 —	
— 15, —	— — 58 —	— — 77 —	
— 16, —	— — 57 —	— — 85 —	
— 17, —	— — 53 —	2.0 — 87 —	
— 18, —	— — 55 —	— — 85 —	
— 19, —	— — 57 —	1.30 — 82 —	
— 20, —	— — 58 —	— — 78 —	
— 21, —	— — 58 —	1.0 — 87 —	
— 22, —	— — 62 —	— — 96 —	
— 23, —	— — 65 —	— — 99 —	
— 24, —	— — 63 —	1.30 — 88 —	
— 25, —	— — 63 —	1.0 — 90 —	
— 26, —	— — 63 —	— — 91 —	
— 27, —	— — 68 —	— — 75 —	Heavy rain.
— 28, —	— — 68 —	— — 80 —	
— 29, —	— — 68 —	— — 87 —	Good shower in afternoon.
— 30, —	— — 69 —	— — 90 —	
— 31, —	— — 69 —	— — 82 —	
April 1, —	— — 69 —	1.30 — 85 —	Few drops. Much rain in hills.
— 2, —	— — 71 —	— — 87 —	Steady rain for 2 hours.
— 3, —	— — 66 —	— — 82 —	No rain, but river came down in strength.
— 4, —	— — 70 —	— — 72 —	Good shower.
— 5, —	— — 71 —	— — 82 —	Good shower.
— 6, —	— — 70 —	— — 89 —	
— 7, —	— — 70 —	— — 95 —	
— 8, —	— — 71 —	— — 95 —	Rained in afternoon. Heavy storms all round.

Date.	Morning and afternoon temperature (Fahrenheit).		Rainfall.
April 9, 1909.	6.0 A.M. 70 deg.	1.30 P.M. 67 deg.	
— 10, —	— — 68 —	— — 82 —	
— 11, —	— — 65 —		Shower in early morning.
— 12, —	— — 68 —	— — 83 —	
— 13, —	— — 72 —	— — 95 —	
— 14, —	— — 73 —	— — 97 —	Shower in afternoon.
— 15, —	— — 73 —	— — 87 —	
— 16, —	— — 71 —	— — 85 —	Few short showers in night. Little water coming down river at daylight.
— 17, —	— — 65 —	— — 82 —	Very heavy shower: one could only see for few yards. River in strong flood.
— 18, —	— — 65 —	1.0 — 85 —	
— 19, —	— — 68 —	— — 85 —	
— 20, —	— — 68 —	— — 95 —	
— 21, —	— — 75 —	— — 93 —	
— 22, —	— — 73 —	— — 85 —	Heavy rain-storm a few miles [away.
— 23, —	— — 72 —	— — 82 —	
— 24, —	— — 67 —	— — 87 —	
— 25, —	— — 67 —	— — 88 —	
— 26, —	— — 67 —	— — 87 —	
— 27, —	— — 70 —	— — 91 —	
— 28, —	— — 68 —	— — 92 —	Few drops.
— 30, —	— — 70 —	— — 82 —	
May 1, —	— — 64 —	— — 88 —	
— 2, —	— — 70 —	— — 80 —	Slight shower.
— 3, —	— — 66 —	— — 88 —	
— 4, —	— — 68 —	— — 92 —	
— 5, —	— — 69 —	— — 78 —	Rather dull. Raining all round, [but not here.
— 6, —	— — 72 —	— — 82 —	
— 7, —	— — 71 —	— — 92 —	Slight shower.
— 8, —	— — 72 —	— — 90 —	Little rain in afternoon.
— 9, —	— — 72 —	— — 91 —	Shower in afternoon.
— 10, —	— — 71 —	— — 90 —	Little rain.
— 11, —	— — 73 —	— — 95 —	
— 12, —	— — 69 —	— — 92 —	
— 13, —	— — 72 —	— — 89 —	
— 14, —	— — 71 —	— — 92 —	
— 15, —	— — 72 —	— — 94 —	
		4.0 — 104 —	
— 16, —	— — 72 —	1.0 — 95 —	
— 17, —	— — 73 —	— — 92 —	
— 18, —	— — 70 —	— — 94 —	
— 19, —	— — 73 —	— — 98 —	
— 20, —	— — 72 —	— — 95 —	
— 21, —	— — 70 —	— — 92 —	
— 22, —	— — 71 —	— — 98 —	
— 23, —	— — 70 —	— — 98 —	
— 24, —	— — 71 —	— — 89 —	Heavy rain for about 40 mins.
— 25, —	— — 69 —	— — 82 —	Few drops about 5 P.M. Much rain in immediate neighbourhood.
— 26, —	— — 67 —	2.0 — 90 —	
— 27, —	— — 71 —	1.0 — 89 —	
— 28, —	— — 71 —	— — 90 —	
— 29, —	— — 69 —	— — 88 —	
— 30,		4.0 — 99 —	
— 31, —	— — 71 —	1.0 — 88 —	
June 1, —	— — 71 —	— — 90 —	
— 2, —	— — 70 —	— — 90 —	
— 3, —	— — 69 —	— — 92 —	
— 4, —	— — 68 —	— — 90 —	

Date.	Morning and afternoon temperature (Fahrenheit).				Rainfall.
June 5, 1909.	6.0 A.M.	68 deg.	1.0 P.M.	90 deg.	
— 6, —	— —	69 —	— —	88 —	
— 7, —	— —	68 —	— —	91 —	
— 8, —	— —	66 —	— —	90 —	
— 9, —	— —	68 —	— —	92 —	
— 10, —	— —	68 —	— —	92 —	
— 11, —	— —	75 —	— —	95 —	
— 12, —	— —	75 —	— —	94 —	
— 13, —	— —	73 —	— —	98 —	
— 14, —	— —	73 —	— —	95 —	
— 15, —	— —	72 —	— —	93 —	
— 16, —	— —	71 —			
— 17, —	— —	72 —	— —	92 —	
— 18, —	— —	73 —	— —	94 —	
— 19. —	— —	73 —	— —	95 —	
— 20, —	— —	73 —	— —	93 —	
— 21, —	— —	73 —	— —	90 —	
— 22, —	— —	73 —	— —	92 —	
			3.0 —	100* —	
— 23, —	— —	71 —	1.0 —	95 —	Heavy shower about 6 P.M.
— 24, —	— —	73 —	— —	96 —	
— 25, —	— —	73 —			
— 26, —	— —	71 —	— —	90 —	
— 27, —	— —	72 —	— —	93 —	
— 28, —	— —	71 —	— —	95 —	
— 29, —	— —	70 —	— —	90 —	
— 30, —	— —	70 —	— —	89 —	

* I have a note here that the temperature usually rose to about 100 deg. about 3 P.M.

"For a further period of a little over seven months there was no rainfall at Mandera. This statement is from memory, but I am confident of its accuracy, and am very sorry I cannot find my diary to provide confirmation."

WALTER FEATHER.

HETEROCERA.

Fam. AMATIDÆ.

273. APISA CANESCENS Wlk.

Mandera.—1908: June 18,—1 ♂; Sept. 15,—1 ♂. **1909** Jan. 8,—1 ♂; Jan. 12,—1 ♂; Jan. 16,—1 ♂.
Gan Libbah.—1908: June 24,—1 ♂.

283. METARCTIA BURRA Schaus.

1909: Apr. 20,—1 ♂.

In this and all succeeding species where no locality is mentioned, Mandera is to be understood.

Fam. Arctiadæ.

Subfam. Nolinæ.

63 *c*. Nola chionea Hmpsn.

1908: Mar. 22,—1 ♀.

Subfam. Lithosianæ.

843. Siccia sordida Butl.

1908: Oct. 25,—1 ♀.

Subfam. Arctianæ.

1677. Maenas arborifera Butl.

1908: Apr. 30,—1 ♂; Oct. 18,—1 ♀. **1909**: Mar. 28,—1 ♂; Apr. 8,—1 ♂; Apr. 11,—1 ♂; Oct. 14,—1 ♂. **1910**: Mar. 6, —2 ♂; Mar. 12,—1 ♂; Mar. 14,—3 ♂.

1730 *a*. Diacrisia diversata Hmpsn.

1909: Sept.—1 ♀.

Diacrisia var. near 1812. lineata, Wlk.

1909: May 10,—1 ♂.

1858 *b*. Estigmene griseata, sp. n. (Pl. I. fig. 1, ♀.)

♀. Head and thorax brownish grey, the back of head and tips of tegulæ orange-yellow, the patagia with small black spots near base; palpi black at tips; abdomen fulvous orange with lateral series of small black spots. Fore wing brownish grey; a small black spot at base of cell; black points in the angles of cell and two beyond lower angle. Hind wing white tinged with reddish brown. Underside brownish white, the costal area of both wings tinged with red-brown; hind wing with black discoidal spot.

1909: May 21,—1 ♀ (type). *Exp.* 40 millim.

2068. Teracotona submacula Wlk.

1909: Oct. 22,—1 ♂.

2088. Utetheisa pulchella L.

1909: May 11,—1 ♀; May 21,—1 ♂. **1910**: Jan.,—1 ♂.

2094 *a*. Secusio somaliensis, sp. n. (Pl. I. fig. 2, ♀.)

♀. Head and thorax pale reddish brown tinged with grey; the vertex of head with minute black streak; the tegulæ, shoulders, and patagia near base and tips with black spots ringed with whitish; the metathorax with minute black spot; palpi brown at sides; pectus and legs whitish tinged with brown, the

former with black spot at side; abdomen brownish ochreous with dorsal and sublateral series of black spots, the ventral surface whitish tinged with brown. Fore wing pale reddish brown; a subbasal black point on costa ringed with white; obliquely placed antemedial black spots on and below costa and in cell and spots nearer the base below median nervure and above vein 1, all ringed with white; two diffused waved white medial lines, rather oblique to below the cell, then incurved; obliquely placed postmedial black spots ringed with white below veins 8 and 7, then a series of diffused white spots with minute black points on the spots below veins 5 and 4; a subterminal series of diffused white spots in the interspaces. Hind wing pale grey-brown. Underside of both wings uniform pale grey-brown.

1908: Nov. 13,—1 ♀ (type). *Exp.* 36 millim.

2098. Secusio strigata Wlk.

Mandera.—**1908**: Sept. 25,—1 ♀.
Gan Libbah.—**1908**: June 25,—1 ♂; Nov. 6,—1 ♀. **1909**: Nov. 4,—2 ♀.

Fam. Agaristidæ.

84. Rothia aisha Kirby.

1909: Apr. 8,—1 ♂.

122. Ægocera brevivitta Hmpsn.

1909: May 6,—1 ♀; May 10,—9 ♀. 1 ♀ specimen without data.

162. Tuerta trimeni Feld.

1909: Apr. 5,—1 ♂; Apr. 14,—1 ♂, 1 ♀; Apr. 20 or 21,—1 ♀.

Fam. Noctuidæ.

Subfam. Agrotinæ.

47 *a*. Chloridea albivenata, sp. n. (Pl. I. fig. 3, ♀.)

♀. Head and thorax rufous mixed with ochreous; antennæ brownish, white towards base; palpi, pectus, legs, and abdomen ochreous irrorated with brown, the dorsum of abdomen thickly irrorated. Fore wing ochreous tinged with rufous and slightly irrorated with blackish, a stronger rufous shade along median nervure expanding towards the postmedial line; a diffused blackish streak below base of cell; a faint diffused oblique blackish antemedial line from costa to median nervure; reniform a diffused blackish spot; the veins beyond the cell slightly streaked with white to the postmedial line, which is whitish slightly defined on each side by blackish, bent outwards below costa, then minutely dentate, excurved to vein 5, then oblique, a fuscous

and rufous shade beyond it; a terminal series of black points; cilia whitish tinged with brown. Hind wing ochreous suffused with brown, the terminal area broadly suffused with blackish; a large blackish discoidal spot; cilia white, tinged with brown at base. Underside ochreous, the costal areas irrorated with brown; fore wing with some fuscous along median nervure; both wings with large black discoidal spots and black subterminal shade from below costa to above inner margin.

1909: Oct. 20,—1 ♀ (type). *Exp.* 24 millim.

56. Chloridea obsoleta Fabr.

1909: Mar. 2,—1 ♀.

304. Euxoa spinifera Hübn.

1908: Nov. 20,—1 ♀.

Subfam. Hadeninæ.

1799. Diaphone eumela Stoll.

1909: Feb. 28,—1 ♀; Apr. 8,—1 ♂; Apr. 14,—1 ♀.

1850. Cirphis loreyi Dup.

1909: Jan. 11,—1 ♀.

Subfam. Acronyctinæ.

3139. Perigea capensis Guen.

1908: Nov. 24,—1 ♀.

3552. Iambiodes incerta Rothsch.

1908: June 7,—1 ♀ (in B.M.).

3623 *a*. Thalatha melanostrota, sp. n. (Pl. I. fig. 4, ♂.)

♂. Head and thorax white irrorated with black scales, the latter strongly tinged with rufous except the tegulæ; antennæ fulvous; palpi white, reddish brown above; pectus white; legs white and brown; abdomen red-brown mixed with some white and irrorated with black, the basal crest rufous, the anal tuft and ventral surface white. Fore wing grey, tinged with red-brown except on terminal area and irrorated with large black scales; faint traces of a medial line, oblique towards costa, then sinuous; an indistinct double dark postmedial line, very oblique towards costa, then sinuous and incurved below vein 3; a series of black points before termen. Hind wing white tinged with red-brown, the costal area and termen more strongly tinged; cilia white. Underside of fore wing suffused with brown; hind wing white, the costal area and termen to vein 2 irrorated with brown.

1909: Apr. 8,—1 ♂ (type). *Exp.* 26 millim.

3786. Cetola pulchra B.-Baker.

1909: Apr. 6,—1 ♀; Apr. 9,—1 ♀; Apr. 14,—1 ♂.

3792 *a*. Matopo heterochroa, sp. n. (Pl. I. fig. 5, ♂.)

Antennæ of male bipectinate with rather long branches to apex, of female ciliated.

♂. Head and tegulæ ochreous white, the latter with slight brown lines at middle and tips; thorax bluish white slightly mixed with pale brown; palpi with the 2nd joint, except at tip, and the 3rd joint brown; frons with lateral brown bars; pectus, legs, and abdomen creamy white, the fore tibiæ and the tarsi banded with blackish. Fore wing bluish white tinged in parts with brown, especially on costal and terminal areas, the veins of terminal half with slight dark streaks; a subbasal brown point below costa; antemedial line slight, dark brown, angled outwards below costa and strongly in submedian fold and above inner margin; claviform defined by dark brown, minute; reniform faint, yellowish with slight brown centre; postmedial line slight, dark brown, defined on outer side by yellowish except towards costa, strongly bent outwards below costa, then waved, incurved below vein 4, and with a slight brown shade before it towards inner margin, some white points beyond it on costa, and slight black-brown streaks above and below vein 6 and between veins 4 and 2; cilia intersected by slight white streaks. Hind wing pure white, the terminal area slightly tinged with brown. Underside white.

♀. More strongly tinged with reddish brown; fore wing with round whitish orbicular stigma and some fiery red on outer edge of reniform and on the yellowish beyond the postmedial line; hind wing suffused with reddish brown; underside tinged with red-brown.

1908: Oct. 13,—1 ♀ (type); Nov. 24,—1 ♂ (type). **1909**: Mar. 12,—1 ♀; Apr. 14,—1 ♀; Apr. 20,—1 ♀; Apr. 22,—1 ♀; Apr. 26,—1 ♀; Sept. 30,—1 ♀; Oct. 22,—1 ♀; Nov. 6—1 ♀. *Exp.* 32-36 millim.

3878. Laphygma exigua Hübn.

1909: Jan. 15,—1 ♂, 1 ♀.

Genus Odontoretha, nov.

Type, *O. featheri*.

Proboscis fully developed; palpi porrect, short, slender; frons with large, conical, truncate prominence with raised edges produced to two minute teeth below and two at each side; eyes large, round; antennæ of male almost simple; thorax clothed almost entirely with scales, the metathorax with depressed crest; build slender; tibiæ slightly fringed with hair; abdomen clothed with rather rough hair, but without crests. Fore wing long and very narrow; the apex rectangular, the termen evenly curved and not crenulate; veins 3, 4 stalked; 5 from just above angle;

6 from well below upper angle; 7, 8, 9, 10 stalked; 11 from cell. Hind wing with the cell long; veins 3, 4 stalked; 5 obsolescent from just below middle of discocellulars; 6, 7 shortly stalked; 8 anastomosing with the cell near base only.

In key differs from *Prometopus* in the frontal prominence being toothed at edges and the fore wing having veins 3, 4 stalked.

3880 *a.* Odontoretha featheri, sp. n. (Pl. I. fig. 7, ♂.)

♂. Head white; antennæ tinged with fuscous; frons with black bars at sides; palpi mostly black; thorax and abdomen grey-white mixed with some blackish; pectus, legs, and ventral surface of abdomen white, the tarsi black ringed with white. Fore wing grey-white, the terminal half with black scales mixed except a patch in and just beyond the cell from costa to vein 2; the darker area defined on inner side by a faint oblique medial line angled outwards just below the cell, with a black streak in the cell from it to the pale patch, which is somewhat constricted at discal fold. Hind wing white; a brown discoidal striga and some faint striæ on termen except towards tornus; the underside with some black on costa towards base, a rather diffused black mark on vein 8 just beyond the cell, and the costal area slightly irrorated with black towards apex.

1909: Mar. 12,—1 ♂ (type). *Exp.* 24 millim.

3989. Athetis leuconephra Hmpsn.

1908: Sept. 24,—1 ♀; Sept. 27,—1 ♀; Oct. 13,—1 ♀.

3998 *a.* Athetis discopuncta, sp. n. (Pl. I. fig. 8, ♀.)

♀. Head and thorax creamy white irrorated with rufous and a few black-brown scales; antennæ brown except at base; palpi tinged with red-brown towards tips; abdomen whitish suffused with red-brown. Fore wing white irrorated with pale red-brown and a few black-brown scales; small subbasal, antemedial, and postmedial black spots on costa; a black point just beyond the cell; traces of a postmedial line formed by red-brown and black scales arising from the costal spot, excurved from below costa to vein 4, then incurved; some minute blackish streaks on post-medial part of costa; subterminal line represented by slight blackish streaks and spots except towards costa; the terminal area tinged with rufous except at apex; a series of small black spots just before termen; cilia rufous at base, chequered rufous and white at tips. Hind wing white, the termen tinged with rufous except towards apex. Underside white, the costal and terminal areas of fore wing and apex of hind wing irrorated with rufous.

1909: Sept. 11,—1 ♀ (type). *Exp.* 28 millim.

4020 *a.* Athetis ectomelæna, sp. n. (Pl. I. fig. 9, ♂.)

♂. Head and thorax ochreous; antennæ brownish; palpi blackish at sides; tibiæ irrorated with blackish, the tarsi blackish

with pale rings; abdomen ochreous white with diffused fuscous dorsal bands. Fore wing ochreous; a minute black subbasal spot on costa and slight point below the cell; a small black antemedial spot on costa, and traces of a sinuous line with slight black marks on it below the cell and above inner margin; two small black spots at middle of costa; a black subterminal band, broad at costa and narrowing to a point at inner margin, extending, except towards apex and tornus, to beyond the slight pale subterminal line, which is slightly angled outwards at vein 7 and excurved at middle; the termen ochreous with a series of minute black lunules; cilia whitish, tinged with brown at base. Hind wing white, with a slight brown terminal line except towards tornus; cilia ochreous at base, white at tips, and with a brown line through them towards apex. Underside white, the fore wing and costa of hind wing tinged with ochreous; fore wing with the terminal area suffused with fuscous except towards tornus; the cilia ochreous at base followed by a brown shade and the tips white; hind wing with some brown on apical part of termen.

1908: Oct. 20,—1 ♂ (type). *Exp.* 30 millim.

Genus Constantiodes, nov.

Type, *C. pyralina.*

Proboscis absent; palpi upturned, the 2nd joint reaching to vertex of head, slenderly scaled, the 3rd moderate, thickly scaled; frons smooth, with ridge of hair above; eyes large, round; antennæ of male bipectinate with moderate branches, the apex ciliated; thorax clothed almost entirely with scales, the metathorax with depressed crest; tibiæ slightly fringed with hair; abdomen with dorsal crest at base only. Fore wing narrow, the apex rectangular, the termen evenly curved, crenulate; veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form a narrow areole; 11 from cell. Hind wing with veins 3, 4 from angle of cell; 5 obsolescent from below middle of discocellulars; 6, 7 from upper angle; 8 anastomosing with the cell near base only.

In key differs from *Plusilla* in the fore wing being narrow with the termen crenulate.

4030 *a.* Constantiodes pyralina, sp. n. (Pl. I. fig. 35, ♂.)

♂ ♀. Head and thorax white mixed with some red-brown; palpi with some dark brown towards extremity of 2nd joint; abdomen creamy white, dorsally tinged with brown. Fore wing creamy white tinged in parts with brown and slightly irrorated with black, the termen yellowish tinged with rufous; a slight curved blackish subbasal line from costa to vein 4; antemedial line reddish brown defined on inner side by white, oblique to submedian fold, then almost obsolete; some white in end of cell; reniform slightly defined by red-brown, large, somewhat angled

inwards on median nervure, a red-brown shade beyond it from costa beyond the postmedial line followed by some white; postmedial line blackish, oblique towards costa, then slightly waved, at vein 3 retracted to inner edge of reniform, then oblique to inner margin, the veins beyond it with slight black streaks except towards costa; some oblique white and dark striæ on costa towards apex; subterminal line white, slightly waved from below costa to vein 4, then oblique; some rufous at apex; a waved blackish terminal line. Hind wing creamy white; a slight waved brown terminal line; the underside with the apical area irrorated with a few red-brown scales.

1908: June 1,—1 ♀ (in B.M.); Sept. 21,—1 ♂ (type). **1909**: Mar. 11,—1 ♀; Apr. 7,—1 ♂. *Exp.* 22 millim.

4103 *a*. Ethiopica ignecolora, sp. n. (Pl. I. fig. 10, ♀.)

Antennæ of female bipectinate.

♀. Head and thorax fiery rufous; antennæ black; pectus and legs rufous; tarsi dark brown ringed with white; abdomen ochreous brown, the ventral surface whitish tinged with rufous. Fore wing fiery rufous; traces of a curved deeper red antemedial line; a whitish point in middle of cell; reniform defined by whitish points; postmedial line indistinct, deep red, oblique towards costa, then slightly waved, excurved to vein 4, then incurved; some slight whitish points beyond it on costa; subterminal line represented by a slight whitish striga from costa and whitish points above and below vein 6 further from termen; a terminal series of slight whitish points. Hind wing white, the costal area, and terminal area to vein 2, tinged with pale brown. Underside of fore wing brownish white, the costal area red; hind wing with the costal edge red.

1909: Dec. 15,—1 ♀ (type). *Exp.* 26 millim.

4103 *b*. Ethiopica phæocausta, sp. n. (Pl. I. fig. 11, ♀.)

♀. Head, thorax, and abdomen deep purplish red tinged with brown; antennæ black; palpi black-brown except at tips; tarsi black-brown with slight pale rings. Fore wing deep purplish red tinged with brown; a very indistinct sinuous brownish antemedial line; reniform red incompletely defined by ochreous, narrow; postmedial line indistinct, dark, oblique to vein 6, then dentate and incurved below vein 4, some minute pale points beyond it on costa, a terminal series of ochreous points. Hind wing white tinged with brown, the cilia pure white at tips. Underside of fore wing pale brown; hind wing white, the costal half suffused with brown.

1909: May 9,—1 ♀ (type); May 10,—1 ♀. *Exp.* 26 millim.

4524. Elydna bisignata Hmpsn.

1909: May 12,—1 ♀.

4676 *a*. RABILA ALBIVIRIDIS, sp. n. (Pl. I. fig. 13, ♂.)

Antennæ of male laminate and minutely ciliated.

♂, ♀. Head, thorax, and abdomen white slightly mixed with brownish; antennæ tinged with ochreous. Fore wing pale yellow-green irrorated with white, the costal area whiter to beyond middle. Hind wing white tinged with brown. Underside white; fore wing suffused with brown, except the costa and inner area which are irrorated with brown; hind wing with the costal and terminal areas irrorated with brown.

Ab. 1. ♀. Fore wing with deeper green patch with a golden tinge and defined by whitish on inner basal area, its outer edge rounded and a similar small round spot distinctly defined by white before tornus.

1908: May 28,—1 ♀; June 2,—1 ♂; June 21,—1 ♂ (type). **1909**: Apr. 6,—1 ♀; Apr. 8,—1 ♂; Apr. 22,—1 ♂; Apr. 23,—1 ♀; May 8,—1 ♀ (B.M.); May 10,—2 ♂; Sept. 16,—1 ♀ ab. (B.M.). Year ?: May,—1 ♂. *Exp.* 20–24 millim.

4742 *a*. ACRAPEX ALBICOSTATA, sp. n. (Pl. I. fig. 14, ♂.)

♂. Head whitish mixed with dark brown, the antennæ ringed with brown towards base, thorax white tinged with red-brown, the tegulæ with slight brown medial line; pectus, legs, and abdomen white, the fore legs brown in front. Fore wing white tinged and irrorated with red-brown, the costal edge brown, the inner half dark brown to the postmedial line, extending except at base to discal fold and leaving some yellow on inner margin, met at the postmedial line by an oblique brown fascia from termen below apex; subbasal and antemedial slight double oblique brown striæ from costa; a black point in middle of cell and slight striga on discocellulars with point beyond it; postmedial line slight, brown, strongly bent outwards below costa, then slightly waved, excurved to vein 4, then incurved and double towards inner margin, the area beyond it with black streaks between veins 8 and 4; an oblique slightly waved brown subterminal line below the oblique fascia; a terminal series of black points. Hind wing pure white. Underside white, the costal area of fore wing tinged with ochreous and irrorated with red-brown.

1908: Sept. 26,—1 ♂ (type). *Exp.* 22 millim.

4755. SESAMIA CONIOTA Hmpsn.

1909: Jan. 12,—1 ♀.

Genus PACHYCOA.

Type, *P. olivacea*.

Proboscis fully developed; palpi obliquely upturned, slender, the 2nd joint reaching to about vertex of head and slightly fringed with hair behind at extremity, the 3rd short and thickly scaled; frons with flattened corneous plate at middle covered by a tuft of hair above and corneous plate below; eyes

rather small, round; antennæ of female somewhat laminate and almost simple; thorax thickly clothed with rough scales and hair, the metathorax with spreading crest; tibiæ slightly fringed with hair; abdomen without crests. Fore wing thickly clothed with rough scales, the apex rounded, the termen evenly curved and not crenulate; veins 3 and 5 from near angle of cell; 6 from below upper angle; 7 from angle; 8, 9, 10 stalked; 11 from cell. Hind wing with veins 3, 4 very shortly stalked; 5 somewhat obsolescent from well below middle of discocellulars; 6, 7 from upper angle; 8 anastomosing with the cell near base only.

In key differs from *Xantholepis* in the abdomen being without crests.

4824 *a*. Pachycoa olivacea, sp. n. (Pl. I. fig. 12, ♀.)

♀. Head whitish tinged with olive-brown and the frontal tuft with rufous; antennæ and palpi brown; thorax olive-brown, the metathoracic crest darker brown; abdomen olive-brown; pectus, legs, and ventral surface of abdomen whitish suffused with brown. Fore wing olive-brown with a reddish tinge except on terminal area; the 1st line almost medial, slight, whitish, oblique to subcostal nervure, then erect; postmedial line slight, whitish, excurved to vein 4, then oblique; cilia whitish tinged with brown and chequered with chocolate-brown at tips. Hind wing dark brown, the cilia silvery white at tips. Underside brown, the costal and terminal areas of fore wing and the hind wing irrorated with white.

1909: Sept. 16,—1 ♀ (type). *Exp.* 22 millim.

Genus Acroriesis, nov.

Type, *A. ignifusa*.

Proboscis fully developed; palpi obliquely upturned, slender, the 2nd joint reaching to above vertex of head, the 3rd short, thickly scaled; frons with flattened corneous plate at middle covered by a tuft of hair above and corneous plate below; eyes large, round; antennæ of female somewhat laminate and almost simple; thorax clothed with scales and hair mixed, the metathorax with spreading crest; tibiæ slightly fringed with hair; abdomen without crests. Fore wing with the apex rounded, the termen evenly curved and not crenulate; veins 3 and 5 from near angle of cell; 6 from upper angle; 7, 8 and 9, 10 stalked; 11 from cell. Hind wing with veins 3, 4 from angle of cell; 5 somewhat obsolescent from well above angle; 6, 7 from upper angle; 8 anastomosing with the cell near base only.

In key differs from the other genera without an areole in the fore wing having veins 7, 8 and 9, 10 stalked.

4824 *b*. Acroriesis ignifusa, sp. n. (Pl. I. fig. 6, ♀.).

♀. Head and thorax whitish suffused with cupreous red; pectus and legs white, the latter tinged with brown; abdomen brown, the ventral surface white tinged with rufous towards extremity. Fore wing pale grey-brown suffused with cupreous

red to the postmedial line except towards base; a subbasal chocolate-brown spot on inner margin and streak in end of cell; postmedial line double, brown filled in with white, very oblique from costa to vein 6 towards termen, then excurved to vein 4, then very inwardly oblique, with fiery red beyond it, except between veins 6 and 4, followed by a white line; cilia with fine whitish line at base, and white tips. Hind wing white tinged with brown, the cilia pure white. Fore wing grey-brown, the costa white towards apex; hind wing white with small brown discoidal spot and curved postmedial line.

1909: Sept. 16,—1 ♀ (type). *Exp.* 18 millim.

4857 *a.* Euterpiodes pictimargo, sp. n. (Pl. I. fig. 15, ♂.)

Antennæ of male laminate and almost simple.

♂. Head and tegulæ bright rufous; thorax ochreous; fore and mid tibiæ and the tarsi red-brown ringed with white; abdomen ochreous white, the 2nd to 4th segments dorsally tinged with red-brown. Fore wing ochreous white, the area beyond the antemedial line from costa to below the cell and vein 3 suffused with bright rufous to termen; subbasal line black with some rufous before it on costa, sinuous, from costa to submedian fold; antemedial line black, oblique, sinuous, incurved above vein 1; claviform defined by red-brown at extremity; orbicular defined by red-brown, round; reniform with whitish centre and annulus defined by red-brown; a sinuous red-brown medial line; postmedial line black, slightly defined on outer side by white on the rufous area, strongly bent outwards below costa, slightly incurved at discal fold, incurved below vein 4 to below end of cell and excurved above vein 1, some white points beyond it on costa; subterminal line slight, white, defined on inner side by small rather dentate black marks from costa to vein 3, angled outwards at veins 7, 6 and inwards at discal fold, then minutely dentate, a crimson patch beyond it at apex with oblique black striga from apex; a terminal series of minute black lunules defined on inner side by white, more strongly towards apex; cilia pale rufous with a reddish-brown line near base. Hind wing silky white; the underside with the costal area irrorated with red-brown and with faint red-brown postmedial shade from costa.

♀. Thorax, abdomen, and the basal and inner areas of fore wing tinged with rufous; hind wing red-brown, the cilia whitish.

1908: Aug. 15,—1 ♀; Sept. 26,—1 ♂ (type). **1909**: Mar. 15,—1 ♂; Apr. 8,—1 ♀ (type). *Exp.* ♂ 20, ♀ 22 millim.

4857 *b.* Euterpiodes croceisticta, sp. n. (Pl. I. fig. 16, ♂.)

♂. Head and thorax creamy white; frons and palpi tinged with orange, the latter with some black at side of 2nd joint; patagia with orange patches; fore and mid tibiæ tinged with

orange, the tarsi orange ringed with white; abdomen white, suffused with dark brown except at base and extremity. Fore wing creamy white; antemedial line represented by orange striæ from costa and inner margin, a black point above submedian fold and orange point below it, inwardly oblique; postmedial line represented by an orange striga from costa, black points above and below vein 5, and below the end of cell by a black point above submedian fold, black and orange point below it, and orange striga from inner margin. Hind wing silky white with a very faint brown tinge. Underside of fore wing suffused with brown.

1909: Mar. 26,—1 ♂ (type); May 8,—1 ♀; May 10,—1 ♂. *Exp.* 14 millim.

4885 *a*. Paratuerta nana, sp. n. (Pl. I. fig. 17, ♂.)

♀. Head and thorax white with some brown scales; antennæ ringed with brown towards base; abdomen white dorsally irrorated with brown, the double basal crest with some blackish scales with a metallic gloss. Fore wing white irrorated with brown, the terminal area more thickly irrorated; a sinuous black-brown streak in submedian fold to the postmedial line, with the area below it and also the area from just before the postmedial line to the subterminal line chocolate-brown mixed with grey; antemedial line hardly traceable to submedian fold, then blackish and strongly angled outwards above inner margin; a faint diffused reddish-brown spot in end of cell almost conjoined to a similar discoidal spot; postmedial line black-brown, obliquely curved and slightly waved from costa to the streak in submedian fold where it terminates, the brown before it angled inwards at discal fold; subterminal line black-brown, obliquely curved and slightly waved, angled inwards at vein 1; a fine dark terminal line. Hind wing ochreous yellow, the inner area tinged with reddish brown; the postmedial area reddish brown to near termen, which is yellowish irrorated with brown; a terminal series of brown striæ. Underside of both wings white, the terminal areas broadly suffused with brown, the costal area of fore wing irrorated with brown.

♂. Fore wing with the costal area and disk grey irrorated with brown and hardly paler than the inner and terminal areas, the orbicular and reniform defined by dark brown, the latter faintly on outer side, the former round; hind wing brownish ochreous.

1909: Apr. 11,—1 ♂ (type); Apr. 30,—1 ♀ (type). *Exp.* ♂ 26, ♀ 30 millim.

Subfam. Erastrianæ.

5068 *b*. Enispa flavipars, sp. n. (Pl. I. fig. 18, ♂.)

♂. Head and thorax rufous; pectus, legs, and abdomen whitish tinged with brown, the last with some rufous at base of

dorsum. Fore wing irrorated with silvery scales, the costal half rufous to beyond the cell, the rest of wing pale olive-green banded with pale yellow; an indistinct interrupted antemedial band; a small brown spot in middle of cell and curved discoidal striga; the postmedial line dark and bent outwards below costa with a yellow spot before it at costa, a yellow spot at discal fold and incurved band from vein 4 to inner margin, some yellowish points beyond it on costa; an interrupted maculate subterminal yellowish band. Hind wing irrorated with silvery scales, pale olive-green with the terminal area pale yellow; the underside pale yellow.

1908: Oct. 31,—1 ♂ (type). **1909**: Mar. 12,—1 ♂. *Exp.* 16 millim.

5142. Eublemma admota Feld.

1909: Oct. 11,—1 ♀.

5144. Eublemma reducta Butl.

1908: June 1,—1 ♂; Oct. 13,—3 ♂; Oct. 23,—1 ♂; Nov. 17,—1 ♂. **1909**: May 8,—1 ♀; May 10,—1 ♂, 1 ♀.

5149. Eublemma nigrivitta Hmpsn.

Mandera.—1908: Sept. 20,—1 ♂; Oct. 11,—1 ♂. **1909**: Mar. 12,—1 ♂; Mar. 26,—1 ♂.

Hargaisa.—1908: Oct.,—1 ♂.

5158*a*. Eublemma eremochroa, sp. n. (Pl. I. fig. 19, ♂.)

♂. Head, thorax, and abdomen ochreous slightly tinged with rufous; antennæ tinged with fuscous; palpi and fore legs blackish. Fore wing ochreous tinged and irrorated with rufous and with a few blackish scales; the costal edge blackish towards base; traces of a waved rufous antemedial line; minute black points in middle of cell and on discocellulars sometimes present; traces of a rufous medial line, oblique to the discocellulars, then inwardly oblique; postmedial line indistinct, rufous, oblique towards costa, then inwardly oblique, very slightly waved and sometimes with some blackish scales on it; some faint pale and rufous marks on costa towards apex; an oblique rufous subterminal shade with a series of minute white points on it, sometimes with some black scales on their outer edges and with one to three black points towards costa; a terminal series of black points with more prominent spot at submedian fold. Hind wing white with a faint rufous tinge; traces of a sinuous rufous postmedial line; a punctiform blackish terminal line. Underside of fore wing suffused with red-brown except the marginal areas; hind wing with the costal area irrorated with rufous.

♀. Fore wing more strongly suffused with rufous, the white points on the subterminal line usually obsolete; hind wing more strongly tinged and irrorated with rufous.

1908: July 19,—1 ♀; July 31,—2 ♂. **1909**: Jan. 9,—1 ♀;

Jan. 14,—1 ♂ ; Jan. 15,—1 ♀ ; Jan. 17,—1 ♀ ; Jan. 18,—1 ♂ (type) ; Jan. 19,—1 ♂, 1 ♀ (type); Mar. 30,—1 ♂. *Exp.* 18–22 millim.

5214. Eublemma scitula Rmbr.

1908: June 29,—1 ♀ ; Sept. 16,—1 ♀ ; Sept. 17,—1 ♀ ; Oct. 28, —1 ♀ ; Nov. 17,—1 ♂ ; Nov. 19,—1 ♂. **1909** : Jan. 19,—1 ♀ ; Feb. 22,—1 ♀ ; Mar. 13,—1 ♂.

5282 *a*. Eublemma ochricosta, sp. n. (Pl. I. fig. 20, ♀.)

♀. Head white, the antennæ tinged with ochreous, the palpi with grey-brown ; thorax whitish tinged with grey-brown ; pectus and legs white, the fore legs tinged with grey-brown, the mid and hind legs with ochreous ; abdomen ochreous white. Fore wing ochreous white suffused and irrorated with grey-brown, the costal area broadly ochreous ; black points in cell towards extremity and on discocellulars with a slight white streak between them ; some very slight white streaks in the interspaces of terminal area, the streak in discal fold extending to near end of cell. Hind wing white with an ochreous tinge.

1909: Feb. 23,—1 ♀ (type). *Exp.* 18 millim.

5282 *b*. Eublemma arenostrota, sp. n. (Pl. I. fig. 21, ♂.)

♂. Head white, the antennæ and palpi tinged with ochreous ; thorax whitish mixed with grey-brown ; pectus, legs, and abdomen white tinged with ochreous. Fore wing ochreous irrorated with white and grey-brown except on terminal area, the ochreous forming diffused fasciæ on median nervure and above vein 2 to the oblique grey-brown subterminal shade ; the costal edge white ; minute brown spots on each side of discocellulars ; some slight brown points on termen ; cilia white and grey-brown with a fine white line at base. Hind wing white slightly tinged with ochreous. Underside of both wings almost pure white.

1909: Jan. 20,—1 ♂ (type). *Exp.* 20 millim.

5296. Eublemma conistrota Hmpsn.

1908: Aug. 24,—1 ♀.

5320 *a*. Toana nigrilineata, sp. n. (Pl. I. fig. 22, ♂.)

♂ ♀. Head, thorax, and abdomen pale grey-brown ; antennæ ringed with black ; palpi, frons, and fore legs black-brown. Fore wing pale brownish grey slightly irrorated with dark brown ; a small subbasal black spot on costa ; antemedial line strong, black, oblique to submedian fold, then incurved to inner margin ; a slight brownish medial line, excurved beyond lower angle of cell and above inner margin ; postmedial line strong, black, arising from the same point on costa as the medial line, oblique and sinuous to vein 4, then inwardly oblique to submedian fold and excurved above inner margin ; traces of a brownish subterminal

line; a strong slightly waved black terminal line; cilia with fine brown lines through them. Hind wing whitish tinged and irrorated with brown; postmedial line almost obsolete on costal half, then black, oblique to vein 4, then inwardly oblique to submedian fold and oblique to inner margin; a black terminal line. Underside whitish tinged with red-brown; hind wing with slight brown discoidal striga.

1909: Mar. 22,—1 ♂ (type); Mar. 26.—1 ♀. *Exp.* 18 millim.

5576 *a*. CHIONOXANTHIA LEUCOPHÆA, sp. n. (Pl. I. fig. 23, ♂.)

♂ ♀. Head, thorax, and abdomen grey-white mixed with brown; palpi black-brown ringed with white. Fore wing grey-white suffused with brown; a slight sinuous blackish subbasal line from costa to submedian fold; antemedial line double, blackish filled in with white and defined on inner side by white, sinuous, a black streak beyond it in submedian fold; orbicular white defined by black, round, some black in the cell between it and the white discoidal bar; postmedial line brown defined on each side by white, obliquely excurved from costa to vein 4, then incurved; subterminal line whitish defined on inner side by diffused brown forming a dark patch on costal area, angled inwards at discal fold, excurved at middle, then incurved and slightly waved; a terminal series of blackish striæ. Hind wing whitish suffused with brown; the underside white irrorated with brown, a small brownish discoidal spot, curved postmedial line, a diffused subterminal line.

1908: May 28,—2 ♀ (1 in B.M.); June 1,—1 ♂ (type); June 2,—1 ♀. *Exp.* 16 millim.

5589 *a*. ŒDICODIA STRIGIPENNIS, sp. n. (Pl. I. fig. 24, ♂.)

♂. Head and thorax red-brown slightly mixed with whitish; antennæ dark brown; palpi at base and the base of 3rd joint white; abdomen grey irrorated with brown; pectus and ventral surface of abdomen white tinged with brown. Fore wing red-brown tinged with grey and irrorated with blackish forming obscure streaks on the veins and above and below submedian fold, except on the terminal area which is slightly paler except at middle and tornus; an indistinct waved brown antemedial line, double at costa; a black discoidal striga with point above it on costa; postmedial line brown, defined on inner side by whitish towards costa, oblique to vein 6, then slightly waved and incurved below vein 4; the postmedial area rather darker brown with some whitish points on costa; subterminal line white defined on inner side by brown, very slightly excurved below vein 7 and at middle; a terminal series of minute black lunules. Hind wing pale red-brown, the cilia white tinged with red-brown at base; the underside white, the costal and terminal areas irrorated with brown, the apex suffused with brown, traces of sinuous postmedial and subterminal lines.

1908: Oct. 15,—1 ♂ (type). *Exp.* 20 millim.

5589 *b*. Œdicodia limbata Butl.

1908: Apr. 28,—1 ♂; May 2,—1 ♀; May 4,—2 ♀; July 16,—1 ♀ (B.M.); July 17,—1 ♂; July 24,—1 ♀; Aug. 15,—1 ♂, 1 ♀; Sept. 13,—1 ♀; Sept. 15,—1 ♀; Sept. 16,—1 ♀; Sept. 23,—1 ♀; Sept. 25,—1 ♀; Sept. 26,—1 ♀; Sept. 27,—1 ♂, 1 ♀; Sept. 29,—1 ♀; Sept. 30,—1 ♀; Oct. 1,—1 ♀; Oct. 3,—1 ♂; Oct. 4,—1 ♀ (B.M.); Oct. 11,—1 ♀; Oct. 13,—1 ♂; Oct. 14,—1 ♀; Oct. 18,—1 ♀ (B.M.); Nov. 17,—1 ♀. **1909**: Jan. 17,—1 ♀; Jan. 19,—1 ♂ (B.M.); Feb. 22,—1 ♂; Mar. 10,—1 ♀; Mar. 11,—1 ♂; Apr. 8,—1 ♂, 1 ♀; Apr. 10,—1 ♂, 1 ♀; May 8,—1 ♂ (B.M.); Nov. 23,—1 ♂. **1910**: Jan. 12,—1 ♀.

5589 *c*. Œdicodia melanographa, sp. n. (Pl. I. fig. 25, ♀.)

♀. Head, thorax, and abdomen pale red-brown; antennæ blackish; palpi except at tips, pectus, legs, and ventral surface of abdomen white, the fore and mid tibiæ tinged with brown, the tarsi brown ringed with white. Fore wing pale red-brown; a black point on costa near base, some scales in base of submedian fold and a slight patch of scales on the costa before the antemedial line, which is black, waved; a black discoidal striga, its lower extremity touching the sinuous blackish medial line, which is excurved to lower angle of cell; postmedial line blackish, approximated to the medial line, slightly waved, oblique to vein 5, then inwardly oblique; subterminal line rather diffused, black, very slightly excurved below vein 7 and at middle; some black scales on termen. Hind wing pale red-brown, the termen rather darker red-brown to vein 2; cilia white slightly tinged with rufous. Underside white tinged with rufous.

1909: Apr. 10,—1 ♀ (type). *Exp*. 24 millim.

5633 *a*. Ozarba semitorrida, sp. n. (Pl. I. fig. 26, ♂.)

♂. Head ochreous brown; thorax red mixed with leaden grey-brown; abdomen pale ochreous; palpi, pectus, legs, and ventral surface of abdomen white, the fore and mid tibiæ and tarsi banded with brown. Fore wing deep red suffused with dark leaden grey, especially towards costa, to the reniform and postmedial line, the rest of wing white tinged with red-brown and with a red patch on postmedial part of costa; minute subbasal white points on costa, in and below the cell; traces of a waved antemedial line defined on inner side by a whitish striga from costa; a white point in middle of cell; reniform white with pale brownish centre, narrow and oblique; postmedial line treble, red-brown filled in with white, obliquely excurved from costa to vein 4, then incurved, touching the upper and lower extremities of the reniform, three white points beyond it on the costal patch; subterminal line white defined on inner side by brown, excurved below vein 7 and at middle; a dark brown terminal line; cilia with brown shades at discal and submedian folds. Hind wing whitish suffused with reddish brown, the cilia whiter. Underside whitish tinged with red-brown except on inner area of hind wing.

♀. Head, thorax, and basal half of fore wing much redder, sometimes crimson-red and with the markings of outer half of fore wing crimson-red.

1908: Sept. 22,—1 ♂; Sept. 30,—1 ♀ (type); Oct. 18,—1 ♀; Oct. 22,—1 ♂ (type). **1909**: Mar. 24,—1 ♀. *Exp.* ♂ 18, ♀ 20 millim.

5635 *a*. Ozarba endoscota, sp. n. (Pl. I. fig. 27, ♀.)

♂ ♀. Head and thorax ochreous, the head between antennæ and patagia with deep red patches, the patagia with black-brown stripes above; antennæ dark brown; pectus and legs white, the fore legs dark brown in front, the tarsi dark brown ringed with white; abdomen white, dorsally suffused with brown. Fore wing with the basal half ochreous tinged with red-brown, the area below the cell suffused with dark brown except at base, the rest of wing grey-white irrorated with dark brown; slight brown marks on costa towards base; an oblique antemedial brown striga from costa and sinuous line from cell to inner margin defined on inner side by whitish and with short brown streaks before it in submedian fold and above inner margin; a brown spot in end of cell and whitish discoidal striga; a small black spot on costa above end of cell; postmedial line hardly traceable, excurved to vein 4, then incurved, some black suffusion beyond it on costa; subterminal line white, curved, a blackish patch beyond it at discal fold; a terminal series of minute blackish spots. Hind wing whitish strongly suffused with brown; the underside white irrorated with brown, the terminal area suffused with brown, a small blackish discoidal spot and curved postmedial line.

1908: Oct. 11,—1 ♀ (type); Nov. 22,—1 ♂. *Exp.* 20 millim.

5637. Ozarba consanguis Hmpsn.

1908: Oct. 17,—1 ♀; Oct. 25,—1 ♀. **1909**: Apr. 7,—1 ♀; Apr. 8,—1 ♀.

5637 *a*. Ozarba hemipyra, sp. n. (Pl. I. fig. 28, ♀.)

♀. Head whitish mixed with blackish, the upper part of frons, antennæ, and palpi blackish, the last with whitish ring at extremity of 2nd joint; thorax black with some reddish scales; pectus and legs ochreous white, the fore legs with some black in front, the tarsi banded with blackish; abdomen reddish ochreous irrorated with black, the basal crest and a bar before the anal tuft black, the ventral surface ochreous. Fore wing black slightly mixed with red to the medial line, the rest of wing fiery rufous with a slight greyish tinge on terminal area; subbasal line black slightly defined by red, waved, from costa to submedian fold; antemedial line black slightly defined on inner side by red at costa and inner margin, waved; medial line closely approximated to the antemedial line, black slightly defined on outer side by white, incurved just below median nervure, a black point beyond

it on costa; postmedial line only defined by a deeper rufous shade on its outer side, excurved to vein 4, then incurved, some whitish points beyond it on costa; subterminal line whitish defined on inner side by a deep rufous shade, excurved below vein 7 and at middle, then waved, some deep rufous beyond it at discal and submedian folds; a terminal series of minute deep rufous lunules. Hind wing whitish suffused with brown and with a fine brown terminal line; cilia paler. Underside of fore wing whitish suffused with brown and with some reddish ochreous at middle of costa; hind wing whitish irrorated with brown and with a small dark discoidal spot.

1908: Oct. 2,—1 ♀ (type). *Exp.* 20 millim.

5638. Ozarba hemimelæna Hmpsn.

1909: Mar. 21,—1 ♀; Mar. 28,—2 ♀; Apr. 7,—1 ♂; Oct. 5,—1 ♀.

5639 *a*. Ozarba hemisarca, sp. n. (Pl. I. fig. 29, ♂.)

♂. Head, thorax, and abdomen ochreous with a faint rufous tinge; palpi except at tips, pectus, legs, and ventral surface of abdomen white, the fore and mid tibiæ ochreous, the tarsi ochreous ringed with white. Fore wing with the basal half ochreous slightly tinged with rufous, the terminal half white slightly tinged with olive-brown; two slight rufous marks on costa towards base; traces of a waved rufous antemedial line with a small deep rufous spot at costa; a red-brown medial line, oblique and sinuous to lower angle of cell, then slightly incurved, with minute blackish spots on it at costa and upper angle of cell and with the area between it and the closely approximated white postmedial line rufous, this line oblique to vein 4, then incurved; subterminal line whitish, defined on inner side by brown towards costa, slightly angled inwards below costa and incurved below vein 3; a black-brown spot at apex and terminal series of points; cilia tinged with red except at apex. Hind wing ochreous white, the area beyond lower angle of cell with a reddish tinge, the termen tinged with brown towards apex; cilia white. Underside ochreous white.

1908: Nov. 19,—1 ♂ (type). *Exp.* 18 millim.

5639 *b*. Ozarba exolivacea, sp. n. (Pl. I. fig. 30, ♂.)

♂. Head and tegulæ pale reddish ochreous; antennæ brown; thorax white slightly tinged with brown; pectus and legs ochreous white, the fore tibiæ and the tarsi brown ringed with white; abdomen ochreous tinged with brown. Fore wing white irrorated with blackish scales, the terminal half faintly tinged with olive-green except at apex, the costa suffused with brown towards base; an indistinct double waved brownish antemedial line; an oblique dark brown medial shade diffused to the postmedial line and on postmedial costal area; reniform with

rufous centre and white annulus, narrow, oblique, and constricted at middle, a whitish patch above it on costa; postmedial line double, dark, oblique towards costa, then excurved to vein 4, then incurved, three white points beyond it on costa; subterminal line whitish defined on inner side by brown, slightly excurved below vein 7 and at middle; a slightly waved brown terminal line; cilia with series of brown marks except at apex. Hind wing ochreous suffused with reddish brown especially towards termen. Underside white irrorated with brown; fore wing tinged with ochreous except the inner area.

♀. Head, thorax, and abdomen ochreous; fore wing with the basal half tinged with ochreous, the terminal half suffused with pale olive-green, the medial shade narrower and not diffused to the postmedial line except below the cell or on the postmedial costal area.

1908: Sept. 22,—1 ♀ (type); Oct. 15,—1 ♂ (type). *Exp.* 22 millim.

5639 *c*. Ozarba mesozonata, sp. n. (Pl. I. fig. 31, ♂.)

♂ ♀. Head, thorax, and abdomen white faintly tinged with brown; antennæ brown; palpi brown at sides except at extremities of 2nd and 3rd joints; tarsi black-brown ringed with white. Fore wing white, the basal area faintly tinged with brown, the terminal area suffused with rufous; two slight dark marks on costa near base; a broad chocolate-brown medial band edged by black lines defined by white, narrower towards costa and slightly constricted in the cell; some whitish points on costa and a brown patch on costal area before the faint brownish subterminal line, which is slightly excurved at middle; a terminal series of black striæ slightly defined on inner side by white; cilia dark brown irrorated with grey, white at apex. Hind wing ochreous white tinged with brown; a fine brown terminal line. Underside white tinged with reddish ochreous.

1908: Sept. 19,—1 ♀; Sept. 21,—1 ♂; Sept. 22,—1 ♀; Oct. 13,—1 ♂ (type). **1909**: Apr. 12,—1 ♀. *Exp.* 16–20 millim.

3639 *d*. Ozarba endoplaga, sp. n. (Pl. I. fig. 32, ♂.)

♂ ♀. Head and thorax ochreous white; antennæ brown; abdomen ochreous tinged with brown; palpi, pectus, legs, and ventral surface of abdomen white, the palpi tinged with brown towards base, the fore and mid tibiæ suffused with brown, the tarsi brown ringed with white. Fore wing creamy white suffused with rufous especially on terminal half; a large conical chocolate-brown patch defined by white on medial area from below costa to inner margin, with slight black streak above it on costa in the male; some whitish points on postmedial part of costa and some brown on costa before apex; a black-brown terminal line defined on inner side by pale yellow which expands towards costa; cilia dark brown with a greyish tinge. Hind wing white tinged with

reddish brown especially in female, the cilia whiter. Underside ochreous white tinged with brown.

1908: Sept. 27,—1 ♀; Oct. 11,—1 ♀ (B.M.). **1909**: Apr. 19, —1 ♂ (type); Nov. 7,—1 ♀. *Exp.* 20 millim.

5656. Ozarba sancta Staud.

1908: June 29,—1 ♂.

5685. Ozarba phæa Hmpsn.

1908: Feb. 11,—1 ♂.

5713. Amyna octo Guen.

1908: Jan. 30,—1 ♂. **1909**: Apr. 7,—1 ♂; Apr. 30,—1 ♀.

5718. Amyna punctum Fabr.

1908: May 29,—1 ♂. **1909**: Mar. 14,—2 ♀; Apr. 6,—1 ♂, 1 ♀; June 25,—1 ♂.

5891. Eustrotia mianoides Hmpsn.

1909: Apr. 7,—3 ♀.

5942 *a*. Eulocastra argyrostrota, sp. n. (Pl. I. fig. 33, ♂.)

♂ ♀. Head and thorax ochreous slightly tinged with rufous; antennæ reddish brown; palpi brown except at tips; tibiæ and tarsi banded brown and white; abdomen brown with white segmental lines, the ventral surface ochreous white irrorated with brown. Fore wing with the basal half ochreous slightly tinged with rufous, the terminal half suffused with red-brown and black-brown and with patches of silver scales; slight subbasal and antemedial brown marks on costa and traces of a sinuous antemedial line with some silvery scales beyond it; a sinuous black medial line defining the inner edge of the dark area; an ochreous discoidal striga with some black before it; postmedial line black defined on outer side by ochreous, more strongly at costa, oblique from below costa to vein 6, slightly incurved at discal fold, oblique and slightly waved below vein 4, an oblique brown line beyond it towards costa; subterminal line represented by silver scales defined on inner side by blackish, forming diffused marks below costa and at middle, excurved below vein 7 and at middle; a terminal series of black striæ slightly defined on inner side by white; cilia with white patches at apex and discal fold. Hind wing whitish suffused with fuscous brown; the underside bluish white irrorated with fuscous brown, the terminal area more suffused with fuscous, a small blackish discoidal spot and curved postmedial line.

1908: Sept. 21,—1 ♀; Oct. 15,—1 ♀; Oct. 24,—1 ♂ (type). Year ?: Oct. 25,—1 ♂. *Exp.* 16 millim.

5984. Lophorache fulvirufa Hmpsn.

1909: Apr. 5,—1 ♀.

6081. Hoplotarache nubila Hmpsn.

1908: Sept. 21,—1 ♀.

6081 *a*. Hoplotarache ectorrida, sp. n. (Pl. I. fig. 36, ♂.)

Hoplotarache nubila, ab. 1, Hmpsn. Cat. Lep. Phal. B.M. x. p. 715.

♂. Head and thorax white, the dorsum of thorax with black scales mixed except in front; antennæ fuscous; palpi black at tips, the frons with lateral black bars; tarsi black ringed with white; abdomen creamy white with dorsal fuscous segmental bands, the ventral surface white. Fore wing white; subbasal line defined on each side by grey, sinuous, from costa to median nervure; grey streaks on costa and above vein 1 before the antemedial line, which is defined on each side by grey, waved, some grey beyond it below median nervure; small dark grey annuli in middle of cell and on discocellulars; an oblique dark grey striga from middle of costa, spot above median nervure and waved black line from cell to inner margin; an oblique dark grey postmedial striga from costa, two black striæ beyond the cell with some grey before them and a waved black line from lower angle of cell to inner margin; the terminal area chocolate-brown, leaving an oblique wedge-shaped white patch on costal area beyond the postmedial line and below the cell extending to the medial line; subterminal line white with two small wedge-shaped black marks before it below costa, excurved below costa and at middle, then incurved and slightly waved, and with black marks beyond it above and below vein 2; a terminal series of small black spots defined on inner side by white; cilia wholly white at middle, red-brown at base, with white tips towards apex and dark leaden-grey tips at discal fold and towards tornus and with slight blackish line through them. Hind wing white; the underside with brown spots at middle of costa and apex and postmedial bar from costa.

♀. Dorsum of thorax grey and black; abdomen red-brown; fore wing with more grey suffusion on the white area; hind wing red-brown, the cilia white at tips; the underside white suffused with brown, a brown discoidal bar and postmedial line excurved beyond the cell.

1908: Nov. 19,—1 ♀. **1909**: Apr. 6,—1 ♀; Apr. 8,—1 ♂, 1 ♀ (types); Apr. 9,—1 ♀; Apr. 10,—2 ♀; Apr. 14,—1 ♀; May 7,—1 ♀; May 9,—1 ♀.

Also in the British Museum from Br. E. Africa, Athi Valley (*Crawshay*), 1 ♂. *Exp.* 20 millim.

6081 *b*. Hoplotarache cæruleopicta, sp. n. (Pl. I. fig. 37, ♂.)

♂. Head, thorax, and abdomen ochreous tinged with rufous; pectus, legs, and ventral surface of abdomen ochreous white, the fore and mid tibiæ and the tarsi brown ringed with white. Fore wing with the basal half creamy white, the terminal half olive-

brown; subbasal line double, olive-brown, sinuous, from costa to vein 1; antemedial line double, olive-brown; a black point in middle of cell and incomplete black discoidal annulus slightly defined by white; medial line dark, defining the pale area, oblique to lower angle of cell, then incurved; an oblique wedge-shaped postmedial creamy-white patch from costa, then a diffused dark line, strongly incurved and with patches of silvery-blue scales beyond it; subterminal line interrupted in places, cupreous red defined on each side by creamy white, excurved to near termen below vein 7 and at middle, then slightly waved; a terminal series of black striæ defined by creamy white; cilia creamy white from vein 4 to submedian fold. Hind wing creamy white, the veins and terminal area tinged with brown; the underside creamy white, the terminal area tinged with brown, a small blackish discoidal spot and faint brownish medial and postmedial bars from costa.

♀. Fore wing with the basal half tinged with red-brown; hind wing cupreous red-brown, the cilia white at tips, the underside creamy white tinged with red-brown, the terminal area suffused with red-brown, a small dark discoidal spot and curved postmedial line.

1909: Apr. 9,—1 ♂; Apr. 15,—1 ♀ (type); Apr. 24,—1 ♂ (type). *Exp.* 22 millim.

6089. Metapioplasta insocia Wlk.

1908: May 4,—1 ♂.

6091 *a*. Aulotarache plumbeogrisea, sp. n. (Pl. I. fig. 34, ♀.)

♀. Head, thorax, and abdomen reddish ochreous, the patagia suffused with leaden grey; pectus, legs, and ventral surface of abdomen ochreous white, the fore legs tinged with red-brown. Fore wing brownish suffused with leaden grey; some ochreous and rufous on inner margin towards base; traces of a sinuous dark antemedial line from cell to inner margin, faintly defined on inner side by ochreous; claviform a very narrow ochreous mark defined by some black scales; orbicular on outer side and reniform on inner side very faintly defined by black; post-medial line dentate, indistinct and brown from below costa to vein 6, then blackish and defined on outer side by yellow and red patches in the interspaces, oblique below vein 4; a terminal series of minute black points defined on inner side by white points. Hind wing white, the costal and terminal areas tinged with brown. Underside of fore wing and costal area of hind wing suffused with reddish brown.

1908: Sept. 23,—1 ♂; Sept. 25,—1 ♀; Oct. 17,—1 ♀ (type); Oct. 24,—1 ♀. **1909**: Apr. 15,—1 ♀; Apr. 20,—2 ♀; May 9, —1 ♀ (B.M.); May 10,—1 ♀; May 12,—1 ♀. *Exp.* 22–26 millim.

6122. TARACHE ZELLERI Wllgrn.

1908: Sept. 18,—1 ♂.

6155. TARACHE UMBRIGERA Feld.

1908: May 24,—1 ♂. **1909**: Apr. 18,—2 ♀.

6167. TARACHE OPALINOIDES Guen.

Mandera.—1908: July 17,—1 ♀. **1909**: Apr. 9,—1 ♀; Apr. 10,—1 ♂; Apr. 27,—1 ♀.
Hargaisa.—1908: Oct.,—1 ♂, 1 ♀.

6175. TARACHE CARNESCENS Hmpsn.

1909: Oct. 22,—1 ♀.

6182. TARACHE HORTENSIS Swinh.

1908: Aug. 16,—1 ♀; Sept. 28,—1 ♀; Sept. 29,—1 ♂. **1909**: Apr. 7,—1 ♀; Apr. 8,—1 ♀; Nov. 24,—1 ♂.

6187 *a*. TARACHE MESOLEUCA, sp. n. (Pl. I. fig. 38, ♂.)

♂. Head, thorax, and abdomen white, the dorsum of thorax behind the tegulæ with grey mixed. Fore wing pale leaden grey, the basal area with some white mixed; a subbasal white point below costa and streak above base of vein 1; a waved white antemedial line; a white medial band; a black annulus in the cell towards extremity and rather elliptical discoidal annulus; a triangular white patch on postmedial part of costa with the faint diffused red-brown postmedial line arising from it, strongly incurved below vein 4; a very indistinct brownish subterminal line with some white on it at costa, incurved and with white scales on its outer edge below vein 3; a terminal series of black striæ defined on inner side by white on inner half; cilia with white mixed from vein 3 to submedian fold. Hind wing white, the costal area and termen, except towards tornus, tinged with brown; the underside white with small brown discoidal spot.
1908: Aug. 15,—1 ♂ (type). *Exp.* 18 millim.

6191 *a*. TARACHE MIOGONA, sp. n. (Pl. I. fig. 39, ♀.)

♀. Head grey-brown, the palpi white except at tips; thorax brownish white with fuscous scales mixed; pectus and legs white, the fore and mid tibiæ banded with fuscous, the tarsi black ringed with white; abdomen red-brown, the ventral surface white. Fore wing with the basal area brownish white with some red-brown scales towards costa and a grey tinge at base of inner margin, its outer edge rather oblique and diffused; a black point in the cell near base; the rest of wing chocolate-brown tinged with purplish grey; a conical brownish-white postmedial patch on costa with the blackish postmedial line arising from it, incurved below vein 4 to below end of cell and slightly angled outwards at vein 1; subterminal line formed

by brownish-white scales, slightly waved, incurved below vein 3 and ending at tornus; a terminal series of black striæ; cilia with a slight dark line through them. Hind wing pale red-brown, the terminal area darker; cilia fuscous with a white line at base and white tips except towards tornus; the underside with white patch on costa towards apex.

1909: Apr. 10,—1 ♀ (type). *Exp.* 24 millim.

Subfam. Euteleianæ.

6258. Eutelia discistriga Wlk.

1909: Feb. 27,—1 ♀; Apr. 20,—1 ♀; June 12,—1 ♀.

6258 *a.* Eutelia grisescens, sp. n. (Pl. I. fig. 40, ♂.)

♂ ♀. Head, thorax, and abdomen grey, the thorax tinged with rufous; palpi with the base of 2nd and 3rd joints brown; tarsi brownish with pale rings; abdomen with some rufous on dorsum, the crests and anal tuft blackish. Fore wing with the basal area rufous defined by the deeper rufous antemedial line, which is angled outwards below costa, then incurved; the rest of wing grey; a faint reddish-brown medial line, bent outwards to the discocellulars and incurved below the cell; postmedial line black with some fuscous beyond it towards costa, oblique and slightly sinuous to vein 6, then almost obsolete and much interrupted, excurved at middle then incurved, some rufous beyond it at discal fold and in submedian interspace; a brownish patch on costal area with two white points at costa before the subterminal line, some yellowish rufous below and beyond it; subterminal line slight, whitish and somewhat waved, incurved below costa and vein 3; a terminal series of black striæ; cilia dark brown, chequered with white at base. Hind wing grey-white, the terminal area tinged with brown and with brownish streaks on the veins; a fine black terminal line; cilia chequered blackish and white; the underside with the costal area and terminal area to vein 2 tinged with rufous, a blackish discoidal point and punctiform postmedial line.

1909: Mar. 13,—1 ♂. **1910**: Mar. 14,—1 ♀; Mar. 16,—1 ♂ (type). *Exp.* ♂ 22, ♀ 26 millim.

Subfam. Stictopterinæ.

6458. Stenosticta grisea Hmpsn.

1908: Aug. 15,—1 ♂, 2 ♀; Aug. 24,—1 ♀; Sept. 13,—1 ♀; Sept. 21,—1 ♂; Oct. 15,—1 ♂; Oct. 28,—1 ♀. **1909**: Feb. 13, —1 ♂; Mar. 14,—1 ♀; Mar. 22,—1 ♂; Mar. 28,—1 ♂.

Subfam. Acontianæ.

6863. Earias insulana Boisd.

1908: Oct. 31,—1 ♂.

6980. MAURILIA ARCUATA Wlk.

1908: Oct. 25,—1 ♂.

7068. NEGETA LUMINOSA Wlk.

1908: July 11,—1 ♀.

7116. ACONTIA ALBAGO F.

1909: Apr. 24,—1 ♀; Apr. 26,—1 ♀.

7117. ACONTIA GEPHYRIAS Meyr.

1909: May 8,—1 ♂.

Subfam. CATOCALINÆ.

7353. ULOTHRICHOPUS TINCTIPENNIS Hmpsn.

1909: July 6,—1 ♂.

7362. CHELECALA TREFOLIATA Butl.

1910: Jan. 10,—2 ♀.

7367. HYPOTACHA INDECISA Wlk.

1908: July 24,—1 ♂; Aug. 26,—1 ♀.

7423. CYLIGRAMMA LATONA Cram.

1909: May 20,—1 ♀; May 21,—1 ♀; May 23,—1 ♂; May 29,—1 ♂; May 30,—1 ♀; May 31—3 ♂, 2 ♀; June 1, —8 ♂, 6 ♀; June 2,—2 ♀; June 4,—2 ♂; June 5,—1 ♀; June 6,—6 ♂, 4 ♀; June 7,—2 ♂, 1 ♀; June 9,—1 ♂, 8 ♀; June 14,—1 ♂; Sept. 8,—1 ♂. **1910**: June 4,—1 ♀.

7493 *a*. ACANTHONYX SERIOPUNCTA, sp. n. (Pl. I. fig. 41, ♂.)

♂. Head and thorax ochreous yellow, the tegulæ tinged with rufous; antennæ whitish tinged with rufous; abdomen ochreous white with dorsal rufous segmental lines, the ventral surface ochreous. Fore wing ochreous yellow sparsely irrorated with red-brown scales; subbasal red-brown points below costa and cell; a minute antemedial red-brown spot below costa and points on median nervure and vein 1; an oblique chocolate-brown discoidal bar tinged with grey, rather rounded above; a minute postmedial red-brown spot below costa, then a curved series of points on the veins; fine brownish lines on termen and through the cilia. Hind wing white. Underside white; fore wing with the costal area ochreous, the terminal area tinged with ochreous except towards tornus; hind wing with the costal area and the termen narrowly tinged with ochreous.

Hargaisa.—**1908**: Oct.,—1 ♂ (type). *Exp.* 40 millim.

7667. ACHÆA CATELLA Guen.

Mandera.—**1908**: Dec. 17,—1 ♀. **1909**: Jan. 9,—1 ♂; May 24,—1 ♀; May 25,—2 ♀; June 7,—1 ♂; July 9,—1 ♀.

Durbar.—**1908**: Dec. 6,—3 ♂.

7747. Parallelia algira L.

1909: Apr. 8,—1 ♂.

7764 *a*. Parallelia rectifascia Fawcett.

1909: Apr. 22,—1 ♂.

7786. Grammodes stolida Fabr.

1908: May 4,—1 ♀; Aug. 28,—1 ♂; Sept. 11,—1 ♂; Sept. 12, —1 ♂; Sept. 23,—1 ♂; Sept. 25,—1 ♀; Sept. 30,—2 ♀; Oct. 1, —1 ♂. **1909**: Mar. 14,—1 ♂; Apr. 15,—1 ♀; Apr. 24,—1 ♀; May 9,—1 ♂, 4 ♀; May 10,—2 ♂, 5 ♀; May 12,—2 ♀; May 14, —1 ♂; May 21,—1 ♂. **1910**: Feb. 9,—1 ♀.

7792. Chalciope hyppasia Cram.

1908: Nov. 19,—1 ♂.

7855. Mocis repanda F.

1909: June 4,—1 ♂.

8075. Cerocala illustrata Holl.

Mandera.—1908: Feb. 11,—1 ♀; Apr. 28,—1 ♀; May 28,—1 ♀; June 30,—1 ♀; July 27,—1 ♀; July 31,—1 ♂; Aug. 23,—1 ♂; Aug. 26,—1 ♀; Sept. 22,—1 ♂; Oct. 22,—1 ♂; Nov. 13,—1 ♀; Nov. 25,—1 ♀. **1909**: Jan. 9,—2 ♀; Jan. 15,—1 ♀; Jan. 17,—3 ♀; Feb. 14,—2 ♀; Feb. 16,—1 ♀; Feb. 17,—2 ♀; Feb. 21,—1 ♂; Mar. 10,—1 ♀; Mar. 13,—2 ♀; Mar. 17,—3 ♀; Mar. 20,—1 ♂, 1 ♀; Mar. 21,—1 ♀; Mar. 22,—2 ♀; Mar. 24,—1 ♂, 1 ♀; Mar. 26,—4 ♀; Mar. 28,—1 ♀; Mar. 29,—1 ♀; Apr. 7, —1 ♀; Apr. 8,—2 ♂, 2 ♀; Apr. 10,—1 ♂, 2 ♀; Apr. 11,—3 ♂, 1 ♀; Apr. 14,—1 ♂, 1 ♀; Apr. 19,—1 ♀; May 8,—1 ♀; May 10, —1 ♂, 2 ♀; June 9,—1 ♂; Oct. 11,—1 ♂; Nov. 11,—2 ♀; Nov. 12,—2 ♀. **1910**: Mar. 14,—1 ♀.
Gan Libbah.—1908: June 24,—1 ♀.
Berbera.—1908: Mar. 4,—2 ♀.

8077 *a*. Cerocala albimacula, sp. n. (Pl. I. fig. 42, ♂.)

♂. Head, thorax, and abdomen brown mixed with white, the thorax mostly brown, the tegulæ dark brown, white at base and tips; antennæ ringed black and white; tarsi brown ringed with white; ventral surface of abdomen white. Fore wing whitish almost wholly suffused with grey-brown and reddish brown, leaving a rather quadrate white patch beyond the reniform; antemedial line obsolete on costal area, then double, black, slightly sinuous, with diffused silvery and black scales before it, the outer line slightly defined on outer side by white: orbicular and reniform with silvery and brown centres incompletely defined by black; the former small, round, the latter with dark streak before it in lower part of cell; postmedial line black slightly defined on inner side by whitish, excurved below costa and

between veins 3 and 2 to the subterminal line, then retracted upwards to lower angle of cell, waved to vein 1 and oblique to inner margin, some black and silvery scales beyond it in its sinus; subterminal line whitish defined on inner side by black marks and some silvery scales between veins 7 and 3, angled outwards below vein 7 and excurved at middle; a waved dark terminal line; cilia chequered brown and white. Hind wing white suffused with reddish brown; a dark discoidal spot with some white beyond it; an indistinct dark subterminal shade with dark patches beyond it below apex and at middle with white above them; cilia white chequered with brown. Underside white; fore wing with round black discoidal spot, some brown suffusion from below end of cell and fuscous subterminal and terminal marks towards apex; hind wing with black discoidal spot, some brown suffusion from below end of cell to the sinuous brown postmedial shade, and blackish patches on termen below apex and at middle.

♀. Fore wing with more white, especially at base and on terminal area except at apex.

1908: Sept. 29,—1 ♀ (type); Oct. 11,—1 ♂ (type). **1909**: Apr. 7,—1 ♀; Apr. 20,—1 ♂; Oct. 5,—1 ♀; Oct. 14,—1 ♀. *Exp.* ♂ 28, ♀ 34 millim.

8078. Cerocala oppia Druce.

1908: Feb. 1,—1 ♂; Feb. 7,—1 ♀; Feb. 11,—1 ♂; Sept. 17,—1 ♀; Sept. 18,—1 ♀; Sept. 21,—3 ♀; Sept. 22,—1 ♀; Sept. 23,—1 ♀; Sept. 27,—1 ♂; Oct. 3,—1 ♀. **1909**: Feb. 23,—1 ♀; Mar. 1,—1 ♀; Mar. 11,—1 ♀; Mar. 14,—1 ♀; Mar. 19,—1 ♀; Mar. 22,—1 ♀; Mar. 26,—1 ♀; Apr. 6,—1 ♀; Apr. 7,—1 ♂; Apr. 8,—1 ♀; Sept.,—1 ♂; Oct. 5,—1 ♀; Nov. 6,—1 ♀. **1910**: Jan. 5,—1 ♀.

8092. Gnamptonyx innexa Wlk.

Mandera.—1908: July 17,—1 ♀; Sept. 19,—1 ♀. **1909**: Mar. 14,—1 ♂, 1 ♀; Mar. 28,—1 ♀; Mar. 29,—2 ♀; Apr. 8,—1 ♀. **1910**: Mar. 14,—1 ♀; Mar. 20,—1 ♀.

Hargaisa.—1908: Oct.,—1 ♀.

8117. Pericyma metaleuca Hmpsn.

1908: Aug. 24,—1 ♂. **1909**: May 10,—1 ♀.

8125. Cortyta leucoptera Hmpsn.

The series, besides the typical form, includes specimens agreeing with *C. dispar* Püng., *C. fasciolata* Warr., *C. balnearia* Dist., *C. impar* Hmpsn., and *C. eremochroa* Hmpsn., which are evidently forms of one variable species; they also occur together in the Hoggar Mts., S. Sahara, *vide* Rothschild, A. M. N. H. (8) xvi. p. 255 (1915).—G. F. H.

1908: Mar. 22,—1 ♂; July 8,—2 ♀; Aug. 20,—1 ♀ (B.M.); Sept. 16,—1 ♂; Sept. 19,—1 ♂, 1 ♀; Oct. 29,—1 ♂ (B.M.).

1909: Feb. 17,—1 ♀ (B.M.); Mar. 11,—1 ♀ (B.M.); Apr. 7, —1 ♀; Apr. 10,—1 ♀ (B.M.); Sept. 21,—1 ♂ (B.M.), 1 ♀; Sept.,—4 ♂; Oct. 14,—2 ♂ (1 in B.M.), 1 ♀; Oct. 22,—1 ♂; Dec. 28,—1 ♂. **1910**: Feb. 10,—1 ♀; Mar. 20,—1 ♂.

8132. CORTYTA ROSACEA Rebel.

1908: July 17,—1 ♀; Oct. 2,—1 ♀; Nov. 25,—1 ♂ (B.M.). **1909**: Mar. 14,—1 ♂; May 10,—1 ♀; Oct. 14,—1 ♀.

8135. CORTYTA CANESCENS Wlk.

Mandera.—1909: Apr. 14,—1 ♂.
Hargaisa.—1908: Oct.,—1 ♀.

Subfam. PHYTOMETRINÆ.

8292. PHYTOMETRA NI Hübn.

1908: Oct. 1,—1 ♀. **1909**: Apr. 6,—1 ♀; Sept.,—1 ♀.

8295. PHYTOMETRA LIMBIRENA Guen.

Hargaisa.—1908: Oct.,—1 ♂.

8330. PHYTOMETRA ACUTA Wlk.

1909: Mar. 30,—1 ♀; Apr. 6,—1 ♂; Apr. 29,—1 ♀; May 3, —1 ♂; May 21,—1 ♂.

Subfam. NOCTUINÆ.

PANDESMA ANYSA Guen.

1909: Apr. 6,—1 ♂.

POLYDESMA COLUTRIX Geyer.

1908: June 18,—3 ♀; July 2,—1 ♀; July 5,—2 ♂ (1 in B.M.); July 25,—1 ♀; July 26,—1 ♀; Aug. 1,—1 ♀. **1909**: July 13, —1 ♀.

PROCONIS ABROSTOLOIDES Hmpsn.

1909: Sept. 17,—1 ♀; Sept.,—1 ♀; Oct. 11,—1 ♀ (B.M.). **1910**: Feb. 10,—1 ♀.

AUTHADISTIS CAMPTOGRAMMA, sp. n. (Pl. I. fig. 44, ♂.)

Antennæ of male with fasciculate cilia.

♂ ♀. Head and thorax pale red-brown mixed with blackish and some whitish; palpi with some black towards base; pectus whitish; fore tibiæ with a black band, the tarsi black ringed with white; abdomen white tinged with reddish brown. Fore wing pale red-brown mixed with some whitish and irrorated with dark brown; subbasal line black, excurved below costa and ending at submedian fold; antemedial line black, oblique towards costa, then erect and very slightly angled inwards at submedian fold; a double sinuous blackish medial line, oblique to discal fold, then

erect; a curved black discoidal striga; postmedial line black, strongly bent outwards below costa, then excurved to vein 3 with a slight inward curve at discal fold, at vein 3 retracted with a downward curve to lower angle of cell, then erect and sinuous, some slight blackish marks beyond it on costa; subterminal line blackish, slightly waved and interrupted, somewhat angled outwards below veins 7 and 4, then incurved; a waved blackish terminal line. Hind wing pure white. Underside white, the costa of both wings slightly irrorated with brown; fore wing with some black points on terminal part of costa, a minutely waved black terminal line, the cilia brown at tips; hind wing with minutely waved black terminal line from apex to vein 2.

Ab. 1. Fore wing with the postmedial line not retracted to lower angle of cell, but curved downwards between veins 3 and 2, then erect.

1908: Sept. 3,—1 ♀; Sept. 17,—1 ♀; Sept. 18,—1 ♀ ab. 1 (B.M.); Sept. 19,—1 ♀; Sept. 23,—1 ♂; Sept. 24,—1 ♀; Oct. 2, —1 ♀; Oct. 3,—1 ♂ (type); Oct. 24,—2 ♂ (1 in B.M.). **1909**: Mar. 10,—1 ♀ (B.M.); Mar. 17,—1 ♀; Mar. 29,—1 ♀; Apr. 8, —1 ♀. *Exp.* 22 millim.

AUCHENISA CERURODES, sp. n. (Pl. I. fig. 43, ♂.)

♂. Head and thorax white mixed with some rufous and black; antennæ rufous; palpi black towards base; tarsi black; abdomen white, dorsally mixed with rufous and black. Fore wing white slightly irrorated with fuscous brown; black streaks on vein 1 and inner margin to near middle; an antemedial black patch on costa with slight sinuous line from its outer edge to submedian fold; an oblique blackish shade just beyond the cell between veins 6 and 2; a blackish discoidal spot defined at sides by white; postmedial line double, the outer line black, the inner line black at costa, then slight brown and minutely waved, curved, from costa to vein 2, an oblique wedge-shaped black-brown patch beyond it on costal area; traces of an oblique slightly waved brownish subterminal line; a terminal series of black striæ. Hind wing semihyaline white, a black discoidal lunule and terminal series of small black spots, minute towards apex. Underside white; both wings with black discoidal spots and terminal series of striæ; fore wing with the costa suffused with brown expanding towards apex and with white postmedial mark on it.

1909: Oct. 22,—3 ♂ (including type). *Exp.* 32 millim.

CATEPHIA PYRAMIDALIS, sp. n. (Pl. I. fig. 45, ♂.)

♂ ♀. Head and thorax brown mixed with grey-white; palpi white in front; pectus white; tarsi black ringed with white; abdomen whitish, dorsally suffused with brown, the crests blackish. Fore wing grey suffused and irrorated with dark brown; subbasal line black, sinuous, from costa to vein 1; antemedial line black, waved; claviform defined by black; orbicular defined by black

and with blackish point in centre, round; reniform with blackish centre defined on inner side by white and black lines and on outer side by white, narrow and somewhat produced at lower extremity; medial line blackish, oblique to the reniform, oblique and sinuous below the cell; a triangular whitish shade from postmedial part of costa to beyond the reniform; postmedial line black, strongly bent outwards below costa, then excurved with a curve inwards at discal fold, oblique and sinuous below vein 4, a sinuous dark line beyond it, and some white points on costa; subterminal line dark brown, waved, angled outwards at vein 7 and excurved at middle, then incurved; the veins of terminal area with slight dark streaks; a terminal series of small black lunules. Hind wing white, the veins and inner area tinged with brown, the terminal area broadly fuscous brown; cilia white, tinged with brown at apex, middle, and tornus. Underside white, the costal areas irrorated with brown, the terminal area suffused with brown; both wings with blackish discoidal lunules and postmedial line, excurved below costa of fore wing.

Ab. 1. Fore wing with the postmedial triangular patch whiter and more distinct.

Ab. 2. Fore wing with black-brown fascia above vein 1 between the ante- and postmedial lines.

1908: Sept. 21,—1 ♀; Oct. 30,—1 ♀. **1909**: Mar. 9,—1 ♀ ab. 2 (B.M.); Mar. 13,—1 ♀; Mar. 26,—1 ♂; Mar. 30,—1 ♀; Apr. 6, —1 ♀; Apr. 8,—1 ♂, 1 ♀ (♂ is ab. 2, in B.M.); Apr. 10,—1 ♀; Apr. 11,—2 ♀; Apr. 15,—1 ♀; Apr. 18,—1 ♀; Oct. 14,—1 ♂, 1 ♀ (♂, type, B.M.); Oct. 22,—1 ♀; Nov. 6,—1 ♀ (B.M.); Nov. 7,—1 ♀, ab. 1 (B.M.). **1910**: Mar. 6,—1 ♀; Mar. 16, —2 ♀ (1 ab. 1 in B.M.). *Exp.* 24–30 millim.

Catephia poliochroa, sp. n. (Pl. I. fig. 47, ♀.)

♀. Head, thorax, and abdomen white mixed with brown; frons with lateral black bars; pectus white; legs white tinged with rufous. Fore wing whitish suffused with brownish grey; subbasal line black, from costa to submedian fold; antemedial line black, oblique and sinuous to submedian fold, then angled inwards at vein 1, a slight oblique black streak before it above inner margin; claviform red-brown defined by black and with black streak from it to the postmedial line, oblique, with its upper edge extending to median nervure; orbicular and reniform defined by blackish except above, rather elliptical, the latter with some fuscous in its lower part; an oblique blackish shade from costa to the reniform, and waved line from submedian fold to inner margin; postmedial line black, strongly bent outwards below costa, incurved at discal fold, angled outwards at veins 4, 3, then incurved and sinuous; a faint waved whitish subterminal line with slight blackish streaks before it in the interspaces; a fine waved black terminal line; cilia brown with a whitish line at base. Hind wing white, the terminal area fuscous brown, the inner area tinged with brown; cilia white, the tips brownish

at middle. Underside white, the costal and terminal areas irrorated with brown; both wings with brown discoidal spot and subterminal shade.

1909: May 12,—1 ♀ (type). *Exp.* 40 millim.

Catephia pericyma, sp. n. (Pl. I. fig. 46, ♂.)

♂. Head and thorax pale grey mixed with brown, the tegulæ with elliptical black-defined annuli; frons with lateral black bars; tarsi black ringed with white; abdomen brown mixed with whitish, the ventral surface whitish. Fore wing pale grey thickly irrorated with brown and black, the veins beyond the cell with slight dark streaks; a black-brown fascia below base of submedian fold; antemedial line black, excurved below the costa and cell, incurved in the cell and below submedian fold, an oblique black-brown shade before it on inner area, and a shade beyond it in submedian interspace to the postmedial line, filling in the claviform, which is large, defined by black, extending to the cell and acute at extremity; orbicular and reniform large, defined by black, the former round, the latter elliptical; a slight oblique brown shade from middle of costa extending into the reniform; postmedial line black, strongly bent outwards below costa, then oblique to vein 6, oblique from vein 5 to below 4, then strongly incurved, dark brown streaks beyond it on veins 3 and 2, and a black streak just below vein 2 with a slight white mark below it beyond the postmedial line; a waved black terminal line. Hind wing white, the inner area tinged with red-brown, the terminal area dark cupreous brown, broad at costa, narrowing to tornus, its inner edge sinuous; cilia white, with brown line through them between veins 4 and 2. Underside white; fore wing with the costa slightly tinged with purple, a brown discoidal spot, a subterminal brown shade except towards costa and inner margin, the area beyond it irrorated with purplish; hind wing with the costa slightly irrorated with purplish, a brown subterminal shade except towards tornus with some brown and purplish irroration beyond it.

♀. Abdomen whiter; fore wing with the brown shade on basal and median areas more diffused to inner margin, and with slight brown shade before the postmedial line except towards costa.

1909: Mar. 14,—1 ♂, 1 ♀ (types). *Exp.* ♂ 34, ♀ 40 millim.

Catephia mesonephele, sp. n. (Pl. I. fig. 48, ♂.)

♂. Head and thorax whitish mixed with dark brown, the tegulæ except at tips tinged with rufous; frons with black lateral bars; palpi with some dark brown at sides of 2nd and 3rd joints; pectus white; legs tinged with rufous, the tarsi dark brown ringed with white; abdomen white, dorsally suffused with brown, the crests dark brown. Fore wing grey-white tinged with brown, the basal area suffused in parts with dark brown; subbasal line black, sinuous, from costa to submedian fold; antemedial line

black defined on inner side by white, excurved below costa and at middle and more strongly to inner margin, where there is an oblique black bar before it; the medial area with oblique bright red-brown fascia from median nervure through the claviform to the postmedial line at inner margin; claviform defined by black, extending to median nervure, oblique and acute at extremity; orbicular and reniform with white annuli rather incompletely defined by brown, the former with brownish centre, round, the latter with its centre faintly defined by brown and with small brown spot in lower part, large, elliptical; postmedial line black, slightly bent outwards below costa then slightly sinuous, rather oblique to vein 4 then incurved, a faint brown line beyond it to vein 4; an oblique red-brown shade from apex and faint postmedial line, angled outwards at vein 3; a waved black terminal line forming points at the interspaces; a fine white line at base of cilia. Hind wing pure white, the terminal area fuscous brown from apex to vein 2. Underside of fore wing white, the terminal area broadly suffused with fuscous.

1908: Oct. 3,—1 ♂ (type). *Exp.* 24 millim.

CATEPHIA EURYMELAS, sp. n. (Pl. I. fig. 49, ♂.)

♂ ♀. Head and thorax grey-white mixed with brown, the tegulæ with black lines; frons with lateral black bars; palpi white with some black at sides of 2nd and 3rd joints; pectus white; legs white tinged with rufous, the tarsi rufous ringed with white; abdomen rufous, the crests blackish, the ventral surface white. Fore wing grey suffused in parts with reddish brown, an oblique whitish shade from costa towards apex to end of cell; a subbasal black striga from costa and oblique streak above vein 1; antemedial line double, the outer line black, the inner indistinct, waved, angled inwards above inner margin; claviform slightly defined by black, narrow; orbicular and reniform defined by black, the former round, the latter incompletely defined on outer side and with blackish mark in lower part; postmedial line blackish, bent outwards below costa, then sinuous, oblique to vein 3, then incurved, some white points beyond it on costa; subterminal line reddish brown, diffused on inner side, oblique, excurved below vein 7 and at middle; a terminal series of black points. Hind wing white, the terminal area broadly black-brown from apex to submedian fold, then narrowly black-brown, the inner margin tinged with brown; cilia white with some black-brown at veins 2 and 1. Underside white, the terminal areas of both wings broadly blackish to submedian fold leaving some whitish on costa and termen of fore wing and at apex of hind wing.

Ab. 1. Patagia and basal half of fore wing strongly suffused with black-brown, the latter with the terminal half whiter slightly tinged with brown and with blackish marks at apex, at discal fold beyond the postmedial line and at termen and between terminal parts of veins 3 and 2.

1908: Sept. 25,—1 ♀. **1909**: Mar. 14,—2 ♀; Mar. 15,—1 ♀; Mar. 20,—1 ♀; Apr. 8.—1 ♂ (type), 1 ♀ (B.M.); Nov. 6,—1 ♀, ab. 1 (B.M.). *Exp.* 22–26 millim.

Lyncestis diascota, sp. n. (Pl. I. fig. 50, ♂.)

♂. Head, thorax, and abdomen white mixed with some grey; the tegulæ with black band near tips, the abdomen dorsally suffused with fuscous from near base to beyond middle; tarsi black ringed with white. Fore wing white slightly tinged with grey, a broad oblique fuscous grey shade from costa towards apex to inner margin beyond middle, a slight black streak below basal half of costa, and the veins of terminal area streaked with black; the basal area with grey shades along median nervure and vein 1; a slight oblique dark antemedial line from cell to inner margin; a slight black streak in end of cell; cilia tinged with brown. Hind wing white, the veins towards termen streaked with black, the apex tinged with brown; a blackish terminal line. Underside of fore wing suffused with reddish brown; hind wing with the costal area irrorated with reddish brown, a subterminal shade from costa to vein 2.

♀. Greyer; hind wing with the terminal area broadly suffused with black.

1908: Sept. 16,—1 ♂ (type); Sept. 26,—1 ♂. **1909**: Mar. 19, —1 ♂; Sept. 20,—1 ♀ (type). *Exp.* 28 millim.

Lyncestis amphix Cram.

Year ?: Mar. 20,—1 ♂.

Sphingomorpha chlorea Cram.

Mandera.—1908: Nov. 17,—1 ♂. **1909**: Mar. 28,—1 ♀; Apr. 5,—1 ♂; June 6,—1 ♂, 2 ♀. **1910**: Feb. 9,—1 ♀.
Gan Libbah.—1908: June 24,—1 ♂; June 26,—1 ♀.
Hargaisa.—1909: Nov.,—1 ♂.

Pasipeda sambesita Wlk.

1909: Apr. 24,—1 ♂; May 21,—1 ♀; July 6,—1 ♂.

Oglasa cornuta Hmpsn.

1908: Nov. 17,—1 ♀. **1909**: Mar. 14,—1 ♀; Mar. 28,—1 ♂.

Asplenia rubrescens, sp. n. (Pl. II. fig. 1, ♂.)

♂ ♀. Head and thorax red-brown mixed with some whitish and a few dark brown scales; pectus and legs whitish, the fore tarsi ringed with fuscous; abdomen red-brown, the ventral surface whitish. Fore wing bright rufous with slight dark irroration, a whitish shade tinged with rufous just beyond the cell; slight subbasal blackish points on costa and in the cell; antemedial line black, waved, double at costa; a small black annulus filled in with white in the cell towards extremity, and a slight discoidal lunule

defined by blackish; a diffused blackish medial line, excurved beyond the cell, then incurved and slightly waved; postmedial line indistinctly double, red-brown and blackish filled in with whitish, slightly bent outwards below costa, then slightly waved and produced to black and white points on the veins, excurved to vein 4, then incurved, some pale points beyond it on costa; subterminal line whitish defined on inner side by dentate black marks in the interspaces, excurved below vein 7 and at middle; a terminal series of black striæ; cilia with some white at tips. Hind wing pale red-brown with a dark subterminal shade; some dark suffusion on termen towards apex and a dark terminal line; cilia white at tips; the underside white tinged with rufous, a dark discoidal point, curved red-brown postmedial line with dark points on the veins and slight subterminal shade.

1909: Mar. 26,—1 ♂; Apr. 7,—1 ♀; Apr. 8,—1 ♂; Apr. 9,—1 ♂; Apr. 10,—1 ♀; Apr. 11,—1 ♀ (B.M.); Apr. 15,—1 ♂; Apr. 20,—1 ♀; Apr. 22,—1 ♂; Apr. 23,—1 ♀; May 7,—1 ♂ (B.M.), 1 ♀; May 10,—1 ♂, 1 ♀; May 12,—1 ♂ (type); May 21,—1 ♀. *Exp.* 24–28 millim.

TEPHRIAS TRIGONOSEMA, sp. n. (Pl. II. fig. 2, ♀.)

♀. Head and tegulæ yellow tinged with rufous, the tegulæ with a rufous band behind them; thorax creamy white; antennæ red-brown; legs slightly tinged with brown; abdomen whitish, dorsally tinged with brown. Fore wing creamy white slightly irrorated with red-brown, the costa red-brown to beyond middle; a conical antemedial chocolate-brown patch from just above median nervure, its base extending to the scale-tooth on inner margin and outwardly resting on vein 1; faint oblique rufous antemedial and medial striæ from costa; postmedial line chocolate-brown, arising below costa, straight to vein 4, then retracted upwards to upper angle of cell, then running downwards with a slight inwards curve to submedian fold just beyond the antemedial patch, and with a triangular chocolate-brown patch below it between vein 4 and submedian fold; the area beyond the postmedial line and below the outer part of the antemedial patch suffused with red-brown shading to ochreous at termen; subterminal line indistinct, dark brown, oblique, dentate, angled outwards below veins 7 and 4. Hind wing creamy white suffused with red-brown especially towards termen; the underside creamy white irrorated with red-brown, the apical part of terminal area suffused with brown, a slight discoidal spot and faint curved postmedial line.

1908: Apr. 27,—1 ♀ (type). *Exp.* 22 millim.

PLECOPTERA POLYMORPHA, sp. n. (Pl. II. fig. 3, ♂.)

♂. Head and thorax brownish white slightly irrorated with fuscous; antennæ brownish; pectus and abdomen white. Fore wing white, tinged in parts with pale red-brown and irrorated

with black scales; a slight red-brown subbasal line from costa to submedian fold; antemedial line red-brown, sinuous; two small almost conjoined black discoidal spots; postmedial line red-brown with some diffused blackish at costa, straight and almost erect to vein 4, then slightly incurved, a series of black points beyond it from costa to vein 4; traces of a whitish subterminal line, excurved below vein 7 and at middle; the termen and cilia suffused with red-brown; a fine waved red brown terminal line with minute dark points at the interspaces. Hind wing white tinged with red-brown and irrorated with black, the termen and cilia more strongly tinged with red-brown; a red-brown postmedial line, excurved beyond lower angle of cell; a waved red-brown terminal line. Underside white faintly tinged with brown and irrorated with a few black scales; hind wing with black bar on upper discocellular.

♀. Varying from whitish tinged with rufous to purplish grey suffused with reddish brown, the lines of both wings and discoidal spots of fore wing often indistinct.

Ab. 1. Both wings with strong red-brown shade before the postmedial line which is defined on outer side by white.

1908: Sept. 12,—2 ♀ (1 ab. 1 in B.M.); Sept. 22,—1 ♀; Sept. 24,—1 ♂ (type). **1909**: Mar. 14,—1 ♀; Apr. 18,—1 ♀; Apr. 24,—1 ♀ (B.M.); Apr. 26,—1 ♀ (B.M.); Apr. 27,—1 ♀; Sept.,—2 ♂; Oct. 4,—1 ♀; Nov. 12,—1 ♀ (type).

Also in B.M. from Abyssinia, Tamasso (*Degen*), 1 ♀. *Exp.* 30–32 millim.

PLECOPTERA HYPOXANTHA Hmpsn.

1909: July 6,—2 ♀.

ACANTHOLIPES CIRCUMDATA Wlk.

1909: Oct. 8,—1 ♀.

ACANTHOLIPES TRIMENI Feld.

1909: May 12,—1 ♀.

ANTARCHÆA SUBFLAVALIS Wlk.

1908: Oct. 25,—1 ♂.

ANTARCHÆA FRAGILIS Butl.

1908: Sept. 14,—1 ♀; Nov. 13,—1 ♀. **1909**: Oct. 14,—1 ♀.

TATHORHYNCHUS EXSICCATA Led.

1909: May 10,—1 ♂.

ANOMIS FIMBRIAGO Steph., or EROSA Hübn.

1909: Apr. 6,—1 ♀. The females of *fimbriago* and *erosa* cannot be distinguished with certainty.

CALPE VAGABUNDA Swinh.

Mandera.—**1908**: May 29,—1 ♀; Sept. 16,—1 ♀. **1909**: Mar. 12,—1 ♂; Apr. 15,—1 ♀; Sept. 9,—1 ♀.

Hargaisa.—**1908**: Oct.,—1 ♂ (B.M.).

ARGADESA MATERNA L.

1909: Apr. 6,—1 ♂, 1 ♀; May 21,—1 ♂.

OPHIDERES FULLONICA L.

Hargaisa.—**1909**: July,—1 ♂, 1 ♀.

This species and the last were often seen at light, but were not sufficiently attracted to be easily captured.

Subfam. HYPENINÆ.

SARMATIA INTERITALIS Guen.

1908: Sept. 26,—1 ♂. **1909**: Apr. 22,—1 ♀; May 10,—1 ♀.

SIMPLICIA CAPALIS Wlk.

1908: June 1,—1 ♀.

NODARIA EXTERNALIS F.

1908: June 2,—1 ♂. **1909**: Jan. 16,—1 ♂.

HYPENA STRIGATA F. (ABYSSINIALIS Guen.).

1909: Apr. 6,—1 ♂; May 21,—1 ♂; July 6,—1 ♂.

HYPENA JUSSALIS Wlk.

1909: May 26,—1 ♀. **1910**: Mar. 16,—1 ♀.

HYPENA MASURIALIS Guen.

1909: Apr. 6,—1 ♀; Nov. 10,—1 ♀.

RHYNCHINA ANTIQUALIS Hübn.

1909: Oct. 22,—1 ♀.

RHYNCHINA PERANGULATA, sp. n. (Pl. II. fig. 7, ♀.)

♂ ♀. Head, thorax, and abdomen grey-white mixed with reddish brown; palpi tinged with red-brown and irrorated with black; ventral surface of abdomen white irrorated with brown. Fore wing grey tinged with red-brown and irrorated with black; antemedial line white, very oblique from costa to submedian fold, where there is a small fan of raised scales below its extremity; an elliptical red-brown spot in end of cell with white streak below it on median nervure and small white patch beyond its lower extremity; postmedial line fine, blackish, defined on inner side by white and on outer side also towards costa, very oblique to discal fold where it is acutely angled, then oblique to inner margin below the antemedial line, some white points beyond it on costa and an oblique white shade from apex to its angle; a slight

dentate white subterminal line with oblique chocolate-brown shade beyond it from just below apex, then a series of dentate chocolate-brown marks on its outer edge; a fine chocolate-brown terminal line and white line at base of cilia. Hind wing reddish brown; a fine dark terminal line; cilia paler; the underside whitish tinged and irrorated with brown, a brown discoidal point and curved postmedial line.

1909: Apr. 7,—1 ♀ (type).

Also in B.M. from Br. E. Africa, Taveta (*Rogers*), 2 ♂; Mosambique, 1 ♂; Transvaal, Kranspruit (*Janse*), 1 ♀. *Exp.* 20–26 millim.

Rhynchina revolutalis Zell.

1908: Aug. 24,—1 ♀.

Rhynchina albiscripta, sp. n. (Pl. II. fig. 8, ♂.)

Antennæ of male minutely serrate, with fasciculate cilia.

♂. Head and thorax white irrorated with brown; palpi with the 2nd joint fuscous brown except below, the 3rd with fuscous band; abdomen white, dorsally tinged with brown. Fore wing white suffused with brown, the inner area to the postmedial line and the termen whiter; antemedial line dark brown defined on each side by white, oblique to submedian fold, then inwardly oblique; a minute blackish annulus in the cell towards extremity; a slight white discoidal lunule defined by dark brown; postmedial line black-brown defined on each side by white, oblique to vein 6 and below vein 4; some white points beyond it on costa; a subterminal series of minute white spots in the interspaces, defined on inner side by slight somewhat dentate black marks with dentate white marks before them towards costa; a fine blackish terminal line; cilia with white lines at base and near tips. Hind wing white tinged with reddish brown; a fine brown terminal line; cilia white at tips; the underside white, the costal area and terminal area to vein 3 irrorated with red-brown, a faint curved postmedial line.

1908: Sept. 19,—1 ♂ (type); Oct. 1,—1 ♂.

Also in B.M. from Sudan, Port Sudan (*Mrs. Waterfield*), 3 ♂. *Exp.* 20 millim.

Rhynchina endoleuca, sp. n. (Pl. II. fig. 6, ♂.)

Antennæ of male bipectinate with short fasciculate branches, the apical part ciliated.

♂. Head, thorax, and abdomen grey-white tinged with brown; the crest at base of abdomen fuscous. Fore wing grey-white tinged with brown; a slight white streak in basal half of submedian fold, the area below it paler and tinged with red-brown; antemedial line represented by a striga of raised blackish scales from costa, some black scales on inner area and a small spot further from the base below the cell; a point of raised black scales in the cell towards extremity and a bar from origin of

vein 2 to inner margin with a slight rufous line before it; a slight brown line from above end of cell to vein 6, dentate at veins 7 and 6; some minute blackish streaks on costa towards apex and an oblique whitish shade from apex to end of cell with a rufous tinge on its outer side and short black streaks in the interspaces, ending in an oblique black bar above vein 2 just beyond the bar below the cell; a subterminal series of minute black striæ, oblique from below vein 3 to submedian fold, then erect, with a slight streak beyond it in submedian fold; a slight sinuous blackish terminal line and fine white line at base of cilia which are intersected with black at the veins. Hind wing whitish tinged with red-brown; a fine brown terminal line; cilia whiter, slightly intersected with brown at the veins; the underside white tinged with rufous and irrorated with brown except on basal and inner areas, a brown discoidal point, traces of a postmedial line from costa to discal fold and a punctiform black terminal line.

♀. Fore wing with the basal half suffused with fuscous brown to submedian fold in which the white streak is stronger and the inner area more contrasting, the white shade from apex more prominent.

Ab. 1 much darker.

1908: Sept. 20,—1 ♀ (type); Sept. 27,—1 ♂ (type).

Also in B.M. from Sudan, Port Sudan (*Mrs. Waterfield*), 1 ♂, 1 ♀; Br. E. Africa, Sabaki R. (*Gregory*), 1 ♀; Kitu (*Crawshay*), 1 ♀; Takaunga (*F. Thomas*), 1 ♀; Munisu (*Lord Delamere*), 1 ♀. *Exp.* ♂ 20, ♀ 24 millim.

Magulaba grisea, sp. n. (Pl. II. fig. 4, ♂.)

♂ ♀. Head and thorax black-brown mixed with reddish brown; pectus, legs, and abdomen grey, irrorated with dark brown, the palpi and fore legs suffused with black, the tarsi ringed with whitish. Fore wing grey-white suffused with reddish brown and irrorated with blackish; a sinuous blackish antemedial line; a white point in middle of cell and slight whitish discoidal striga placed on a sinuous blackish medial shade, incurved below the cell; an indistinct blackish postmedial line, excurved below costa and at middle, incurved at discal fold and below vein 4; a brown subterminal shade with series of more or less prominent black marks on it, excurved below vein 7 and at middle; a terminal series of black points. Hind wing grey suffused with brown and irrorated with dark brown; traces of two postmedial lines with the area between them rather paler; a terminal series of fuscous striæ; the underside white irrorated with brown, a dark discoidal striga and rather diffused brown postmedial and subterminal lines.

1908: Feb. 24,—1 ♂ (B.M.); Sept. 13,—1 ♂; Sept. 22,—1 ♂; Oct. 3,—1 ♂; Oct. 29,—1 ♂; Nov. 13,—1 ♂ (type). **1909**: Apr. 20,—1 ♂; Apr. 22,—1 ♀ (B.M.).

Also in B.M. from S. Nigeria, Sapele (*Sampson*), 1 ♂. *Exp.* 22 millim.

NAARDA NIGRIPALPIS, sp. n. (Pl. II. fig. 5, ♂.)

♂. Head and thorax brown mixed with grey; antennæ blackish slightly ringed with grey; palpi blackish; fore legs black, the tarsi slightly ringed with white; abdomen grey suffused with brown. Fore wing grey thickly irrorated with brown; antemedial line dark brown and sinuous: a minute ochreous spot in middle of cell and ochreous discoidal bar defined at sides by dark brown; a rather diffused erect brown medial line; postmedial line dark brown, sinuous, slightly incurved below vein 4; subterminal line whitish defined on inner side by brown, slightly sinuous; a terminal series of dark brown striæ. Hind wing grey suffused with brown; a slight brown discoidal bar and some dark scales at middle of inner margin; a curved waved brown postmedial line; a rather diffused waved subterminal line; a terminal series of dark brown striæ; the underside whitish irrorated with brown, the discoidal bar and postmedial and subterminal lines more distinct.

1908: Oct. 25,—1 ♂ (type). *Exp.* 18 millim.

Fam. LYMANTRIDÆ.

EUPROCTIS FASCIATA Wlk.

1909: Mar. 14,—1 ♂. **1910**: Mar. 10,—1 ♂.

LÆLIA TESTACEA Wlk.

Mandera.—1909: Oct. 6,—1 ♀.
Hargaisa.—1908: Oct.,—2 ♂.

CASAMA VILIS Wlk.

1908: May 2,—1 ♂, 1 ♀; May 4,—1 ♂, 1 ♀: Aug. 15,—1 ♂, 1 ♀; Aug. 24,—1 ♂; Aug. 25,—1 ♀; Aug. 26,—1 ♂, 1 ♀; Sept. 3, 1 ♂: Sept. 15,—1 ♂; Sept. 18.—2 ♀; Sept. 19,—1 ♀; Sept. 21,—1 ♂, 1 ♀; Sept. 22,—1 ♂, 1 ♀; Oct. 3,—1 ♀; Oct. 14.—1 ♂; Oct. 15,—1 ♀. **1909**: Jan. 13,—1 ♀; Jan. 18,—1 ♀; Feb. 17,—1 ♂; Feb. 25,—1 ♀; Mar. 12,—1 ♂; Mar. 13,—1 ♀; Mar. 19,—1 ♀; Mar. 24,—1 ♂; Apr. 6,—1 ♂; Apr. 7,—3 ♂: Apr. 8,—1 ♂; Apr. 11,—1 ♀; Apr. 14,—1 ♂; Apr. 24,—1 ♂; Apr. 26,—1 ♂; Apr. 30,—1 ♂; Aug. 17,—1 ♂; Oct. 5,—1 ♂; Oct. 7,—1 ♂; Nov. 25,—1 ♀. **1910**: Jan. 8,—1 ♂.

DASYCHIRA MISERATA Holl.

1908: Aug. 26,—1 ♂.

DASYCHIRA REMOTA Druce.

Year?: Mar. 24,—1 ♀.

ACLONOPHLEBIA INCONSPICUA, sp. n. (Pl. II. fig. 9, ♂.)

♂. Head, thorax, and abdomen dark red-brown mixed with some whitish. Fore wing whitish tinged with red-brown and thickly irrorated with dark brown, the veins with dark streaks;

a dark brown subbasal patch from costa to below the cell; antemedial line blackish, excurved from below costa to submedian fold where it is slightly angled inwards; traces of a sinuous dark medial line; a curved black discoidal striga; postmedial line blackish slightly defined on outer side by white, somewhat dentate and produced to slight streaks at veins 7 to 2, bent outwards between veins 5 and 3, retracted below vein 2, and slightly angled outwards at submedian fold and vein 1; some slight whitish marks on costa towards apex; cilia brown, intersected with white at veins 7 to 2. Hind wing white, somewhat semihyaline, the veins slightly tinged with brown; the cilia with slight brown spots from apex to vein 2. Underside of fore wing with the terminal area white with a subterminal brown shade rather diffused on inner side and dentate on outer between veins 7 and 3.

Hargaisa.—**1908**: Oct.,—2 ♂ (including type). *Exp.* 30 millim.

Fam. SPHINGIDÆ.

By Dr. KARL JORDAN.

HERSE CONVOLVULI L.

Sphinx convolvuli Linné, Syst. Nat. ed. 10, p. 490. n. 6 (1758).

1909: July 6,—1 ♀; Nov. 6,—1 ♂.

POLIANA MICRA R. & J. (1903).

Poliana micra Rothschild & Jordan, Nov. Zool. ix. Suppl. p. 809, no. 766, text-fig. 6 (1903: Somaliland).

These two males from Mandera are in a better state of preservation than the type, and therefore appear purer grey on the fore wing. The only difference I notice is in the ante- and postmedial double lines being less filled-in with fuscous and a little further apart below the apex of the cell than in the type specimen, the only example hitherto known to us of this species. The genitalia of one of Mr. Feather's specimens have been examined; they are identical with those of the type.

1908: Oct. 31,—1 ♂. **1909**: May 13,—1 ♂.

HIPPOTION CELERIO L.

Sphinx celerio Linné, Syst. Nat. ed. 10, p. 491. n. 10 (1758).

Mandera.—**1909**: Apr. 5,—1 ♂.
Berbera.—**1908**: Dec. 2,—1 ♀.

HIPPOTION ROSEIPENNIS SOMALICUM, subsp. n.

♂ ♀. Ab *H. ros. roseipenni* ala antica in disco lineis quinque fuscis notata distinguendum.

In true *roseipennis* Butl. (1882), which is known to us from Delagoa Bay northward to British East Africa and Unyoro, the fore wing bears two distinct lines in the outer half, the proximal

line crossing the fuscous patch which is placed at the apex of the cell, and the outer line being nearly continuous with the oblique apical streak. In between these two lines there are at most faint traces of two or three other lines parallel with them. In *somalicum*, on the other hand, the three additional lines are quite distinct, the first and second additional lines being in the male nearly, and in the female fully, as well marked as the proximal line. In this character *H. r. somalicum* represents an ancestral stage.

The genitalia do not appear to differ from those of *H. r. roseipennis.*

Mandera.—1909 : Oct. 14,—1 ♀.

Hargaisa.—1909 : Nov.,—1 ♂ (type).

Hippotion rosæ Butl.

Darapsa rosæ Butl. A. M. N. H. (5) x. p. 433. n. 5 (1882).

1909 : Oct. 6,—1 ♂.

Fam. Notodontidæ.

Gargetta xylochroa Hmpsn.

Mandera.—1908 : May 29,—1 ♀; Nov. 22,—1 ♂. **1909**: Feb. 17,—1 ♂.

Hargaisa.—1908 : Oct.,—1 ♂.

Scrancia discomma, sp. n. (Pl. II. fig. 10, ♀.)

♀. Head and thorax white mixed with reddish brown and blackish, the patagia white slightly pencilled with brown; pectus and legs white with a few brown scales; abdomen white tinged with brown and with slight lateral blackish spots except towards extremity. Fore wing white irrorated with a few black scales, the inner half tinged with red-brown, the veins streaked with black except on basal and inner areas and at costa; a small round black-brown discoidal spot surrounded by white. Hind wing white, the terminal area tinged with brown, broadly at costa, narrowing to tornus; cilia white, faintly tinged with brown. Underside of fore wing suffused with brown, the terminal area whiter; hind wing with the costal area suffused with brown.

1908 : Oct. 15,—1 ♀ (type). *Exp.* 35 millim.

Stenostaura impeditus Wlk.

1908 : Feb. 24,—1 ♀.

Fam. Geometridæ.

By Louis B. Prout.

These form, on account of the number of new and interesting species, an extremely important part of Mr. Feather's collection. Their general affinities, as might be expected, are with the fauna of Abyssinia, British East Africa, and to some extent Socotra

and Southern Arabia, and desert forms are strongly in evidence. Nearly all the species are of small size, the majority belong to a few groups (especially Acidaliids and the *Macaria* group), and one extensive subfamily (the Larentiinæ) is almost absent, being represented by only two specimens, while even of these one is the somewhat anomalous *Pseudosterrha philæaria*. The presence, in the groups named, of a number of closely allied and inconspicuous species (in some cases also strongly variable) has rendered a satisfactory working-out of the material a matter of no small difficulty; and this difficulty has been increased by a curious and unexplained circumstance which deserves mention—the very marked preponderance of females, this sex alone being represented in not a few cases where there is quite a good series of examples. We are not unaccustomed to meeting with Geometrid collections in which the *males* alone of many species are present, and are able readily to attribute this to the greater activity of the sex, the fact that the collection was made chiefly at light, and so on; but it is less easy to suggest what difference in habit, or what particular method of collecting, has resulted in the capture of the *females* only of so many species. That the phenomenon is not confined to a single genus or group will be seen by referring to the details given below, under *Hierochthonia featheri*, *Acidaliastis subbrunnescens*, *Tephrina*, nearly the whole of the Acidaliinæ, etc.*

Subfam. Hemitheinæ.

Ten species are represented, most of them more or less highly specialised forms, and including two additions to the handful of known species in which the characteristic green colour of the subfamily has given place to some shade of brown or sand-colour.

Victoria sematoperas, sp. n. (Pl. II. fig. 26, ♂.)

♂ ♀, 32–33 mm. Face and upper side of palpus dark red; crown of head, base of antenna, and basal one-third or more of costa red mixed with lustrous blue-blackish scales. Abdomen dorsally slightly reddish, crests lustrous, pale on summit, then reddish, a deep black spot (dot) near base of each. Fore wing with termen almost smooth; green (in all three discoloured by relaxing); discal dot white, encircled with a black-dusted red ring; distal margin with similarly coloured dark spots, namely a small one in front of R^1, a much larger one from R^1 to beyond R^2, and a small or moderately large one at tornus. Hind wing with the excision between the radials not deep, discal dot as on fore

* [After the above paragraph was written a number of additional specimens of Geometridæ were set and added to the collection. Mr. Prout wrote (Feb. 19, 1915), concerning these additions:—"They do not upset my generalisation as to the preponderance of females; indeed, they rather strengthen it, being almost exclusively of that sex except in one species (*Heterostegane indularia*) whose males were already well in evidence." On this subject see also p. 93.—E. B. P.]

wing or less clearly ringed, tornus with indications of dark markings. Fore wing beneath with the terminal markings weakly indicated, hind wing quite unmarked.

1909: Mar. 14,—1 ♀; Dec. 30,—1 ♂ (type). **1910**: Jan. 2, —1 ♀.

Unfortunately all have lost the hind legs. It is evidently a near ally of *V. triplaga* Prout, from German East Africa.

Prasinocyma perpulverata, sp. n. (Pl. II. fig. 25, ♂.)

♂ ♀, 16–21 mm. Palpus in male rather slight for the genus, in female about $1\frac{1}{2}$ times diameter of eye, with 3rd joint exposed but rather short for the genus. Antenna of male with the outer pectinations longish, the inner much shorter. Hind tibia of male not dilated, the four spurs closely approximated. Head, body, and legs concolorous with wings, the vertex appreciably paler than the face. Wings rather narrower than in typical *Prasinocyma*, hind wing not at all bent at R^3, cells relatively long (fully one-half); fore wing with SC^1 generally free, R^1 not or very shortly stalked, M^1 connate or very shortly stalked, hind wing with two stalkings. White-grey with a slight tinge of brown, coarsely irrorated with fuscous, the irroration under a lens inclining to resolve itself into minute longitudinal strigulæ; cell-spots strong, elongate. Under surface less strongly irrorated.

Apparently variable, the name-typical form, with uniform irroration, the commonest; here I refer the following:—

Mandera.—**1908**: June 1,—1 ♀; July 17,—1 ♀; Sept. 27, —1 ♂, 1 ♀. **1909**: May 10,—2 ♀, 1 ♂ (type).

Three females show on the fore wing an ill-defined dark basal patch, dark median band from hind margin about to cell, and dark terminal dashes between the veins: ab. **subfasciata, ab. n.**

Mandera.—**1909**: May 10,—1 ♀. **1910**: Mar.,—1 ♀ (type). **Hargaisa.**—**1908**: Oct.,—1 ♀.

One male is smaller (16 mm.) and with still more markings, the median area being broadly dark-mixed in *anterior* half, a dark proximal shading (forming a large, strong spot at costa) indicating the position of the obsolete subterminal line, the hind wing somewhat shorter, with distal area somewhat darkened, the antennal pectinations apparently continuing slightly less far down the shaft: ab. **perscripta, ab. n.** (? **sp. div.**).

Mandera.—**1908**: July 17,—1 ♂ (type).

By the length of the cells and the female palpus, as well as by the facies (which recalls *Neromia pulvereisparsa* Hmpsn.), *perpulverata* should probably be made the type of a new genus.

Chlorissa stibolepida (Btlr.)*.

Comibæna stibolepida Btlr. Cist. Ent. ii. p. 394 (1879).

* [The parentheses around the names of authors placed after scientific names in this paper are used in accordance with Article 23 of the International Rules of Nomenclature (Proc. 7th Int. Cong., Boston 1907, p. 44 (1912)).—Editor.]

Hemithea albistrigulata Warr. Nov. Zool. iv. p. 39 (1897).
Hemithea vermiculata Warr. ibid. p. 41 (1897) (n. syn.).

1909: Apr. 20,—1 ♀; Apr. 24,—1 ♀.

A very widely distributed African species, and perhaps not structurally differentiable from *C. faustinata* Mill. (S. Palæarctic) and *C. solidaria* Guen. (Indian).

NEROMIA MALESCRIPTA (Warr.).

Hemithea malescripta Warr. Nov. Zool. iv. p. 40 (1897).

1908: Nov. 13,—1 ♂. **1909**: Mar. 1,—1 ♂.

Both examples small, with the crests red.

Distributed in Abyssinia, British East Africa, Transvaal, and Natal. I have a note, dealing with the difficult group to which this species belongs, in the press for the 'Annals of the Transvaal Museum.'

NEROMIA MANDERENSIS, sp. n. (Pl. II. fig. 24, ♀.)

♀, 20–22 mm. Face and palpus red. Vertex and antenna whitish, the latter with minute ciliation; occiput green. Thorax and abdomen concolorous with wings. Wings above green with whitish strigulation, quite like the greenest forms of *Chlorissa stibolepida* Btlr., costal edge of fore wing ochreous, otherwise markingless; fringes green, lighter distally. Under surface paler green, costal edge of fore wing as above.

Mandera.—1908: Sept. 25,—1 ♀ (type); Nov. 13,—1 ♀. **1909**: May 8,—1 ♀.

Hargaisa.—1908: Oct.,—1 ♀ (a worn example).

Hind wing less elongate than in *Chlorissa stibolepida*, termen smoothly rounded; but best distinguished by the structure. Palpus reaching beyond frons and shortly rough-scaled, but with 3rd joint small; hind tibia with terminal spurs only. If the male antenna should prove to be pectinate, the species should be considered a *Microloxia*, aberrant in the rather short 3rd joint of the palpus.

Genus HEMIDROMODES, nov.

Palpus slender, in male rather short, in female moderate, in both sexes with 3rd joint short or shortish. Tongue absent. Antenna short and rather thick, in male with moderate, in female with short pectinations. Pectus somewhat hairy; hind tibia in male short, greatly dilated (recalling that of *Synclysmus*), all the spurs present, terminal very short, the outer almost obsolete; in female with terminal spurs well developed, median short, sometimes entirely absent. Abdomen not crested, in female robust. Frenulum in male slight, in female absent. Fore wing with SC^1 from cell, free, R^1 about connate with SC^{2-5}, R^2 rather far forward, M^1 about connate or very shortly stalked with R^3. Hind wing with termen smooth, C anastomosing to

scarcely one-half cell, DC not very oblique, SC^2 well stalked. R^2 little before middle of discocellulars, M^1 well stalked.

Type of the genus: *Hemidromodes robusta* Prout (*Hierochthonia*).

A connecting link between *Hierochthonia* and *Syndromodes*; the absence of the male, and the curious fact that the female examined had no trace of median spurs (though both legs are in good condition), led me to refer the species to the former genus. From *Syndromodes* it differs in antenna, male hind leg, robust female abdomen, etc.

HEMIDROMODES ROBUSTA (Prout).

Hierochthonia robusta Prout, Nov. Zool. xx. p. 435 (1913).

6 ♂, 14–18 mm.; 6 ♀, 18–24 mm.

1908: June 1,—2 ♂; July 17,—1 ♂; July 31,—1 ♀; Aug. 24, —1 ♂. **1909**: Jan. 16,—1 ♀*; Mar. 19,—1 ♀; Mar. 24,—1 ♀; Apr. 11,—1 ♂; May 10,—1 ♂; May 21,—1 ♀; Nov. 7,—1 ♀*.

Excepting the two females marked *, all are smaller—mostly considerably smaller—than the type specimens from Port Sudan.

In this species the fringes (which in neither of the originals were quite perfect) are long, proximally green, distally ochreous whitish.

HIEROCHTHONIA FEATHERI, sp. n. (Pl. II. fig. 23, ♀.)

♀, 24–26 mm. Face green. Palpus minute, whitish. Tongue vestigial. Antennal shaft white, pectinations long. Vertex white; occiput green. Thorax above green, beneath white. Abdomen robust, dorsally green, becoming white posteriorly and ventrally. Fore wing moderately broad, SC^1 from cell, anastomosing with C, SC^2 from shortly after R^1, anastomosing with SC^1, R^1 well stalked, R^2 rather extremely placed, M^1 shortly stalked; uniform bright green, nearly as the genus *Euchloris* or slightly more bluish, distal one-third of fringe white. Hind wing moderately broad, costal margin rather long, apex rounded, C anastomosing to near end of cell, R^2 rather extremely placed, M^1 short-stalked; green, rather paler than fore wing, especially towards base and costal margin. Under surface pale green.

1908: Nov. 20,—1 ♀. **1909**: Jan. 15,—1 ♀; Jan. 16,—1 ♀; Jan. 22,—1 ♀; Apr. 10,—1 ♀; Apr. 12,—1 ♀; Apr. 15,—1 ♀; Apr. 22,—1 ♀; May 9,—1 ♀ (type); Dec. 10,—1 ♀.

Probably related to *petitaria* Chr., notwithstanding the broader wings and strongly pectinate antenna. It is unfortunate that the males in this group are still unknown.

COMOSTOLOPSIS STILLATA (Feld.).

Nemoria stillata Feld. Reise Novara, Lep. Het. t. 127. fig. 17 (1875).

Eucrostes rubristicta Warr. Nov. Zool. vi. p. 23 (1899).

Eucrostis rufostellata Mab. Ann. Soc. Ent. Fr. lxviii. p. 740 (1900).

1909: May 21,—1 ♀.

A quite typical example of this widely distributed African species, extending its known range.

EUCROSTES ASTIGMATICA, sp. n. (Pl. II. fig. 22, ♀.)

♂, 15–16 mm.; ♀, 19–20 mm. Superficially very like *pygmæa* Rbl.* (= *insularis* Prout), but larger, of a still more vivid green, and without the discal dots, the pale postmedian line not discernible, or only suggested in certain lights. "Snow-white," in my description (Gen. Ins. cxxix. p. 246) of the costal edge, was not absolutely accurate, as there is, in a good light, a very delicate tinge of pinkish or violet in the white in both species. Structurally like the African members of the genus, the male palpus being less minute than in *pygmæa*, the 3rd joint in the female rather less long and slender, and the female antenna bipectinate, the longest branches about twice as long as the diameter of the shaft.

1908: Sept. 21,—1 ♂. **1909**: Apr. 21,—1 ♂ (type); Apr. 22,—1 ♀; May 10,—2 ♀.

ACIDALIASTIS SUBBRUNNESCENS, sp. n.

♀, 14–16 mm. Much more strongly and uniformly dusted with sand-colour (sometimes more yellowish, sometimes more brownish) than *micra* Hmpsn., the dark lines only weakly (in the darkest example scarcely at all) indicated, but with very conspicuous white lines proximally to the first and distally to the second; the former of these is more oblique than in *micra*, not reaching costa, the latter forms a rather more appreciable curve than in that species; *discal dot absent.* Hind wing white, becoming more or less tinged with sand-colour towards termen, in the darkest-marked example showing a curved white postmedian line. Fore wing beneath with white outer line and white hind margin, hind wing all white.

1908: June 1,—1 ♀; June 29,—1 ♀; Sept. 14,—1 ♀ (type); Sept. 17,—1 ♀; Sept. 23,—1 ♀. **1909**: Mar. 24,—1 ♀.

Very near *bicurvifera* Prout (Ann. Transv. Mus., in the press), much smaller, costa rather straighter, apex rather less sharp, termen rather less convex in posterior half, palpus and female antennal pectinations slightly shorter, markings less reddish (more olivaceous), postmedian line almost parallel with termen (in *bicurvifera* more oblique), hind wing rather shorter, less unicolorous, face apparently less reddish.

* Denks. Akad. Wien, Math.-nat. Kl. lxxi. 2, Sep. p. 67 (1907). As only separata in advance seem to have been issued of the paper of Rebel's containing this species, and it was not noticed in the 'Zoological Record,' I do not feel to blame for having overlooked it in the 'Genera Insectorum' and created a synonym.

Subfam. ACIDALIINÆ.

Genus TRICENTROSCELIS, nov.

Face rounded, markedly prominent, with appressed scales. Palpus short, shortly rough-scaled. Tongue present. Antenna in female minutely ciliated. Pectus and femora glabrous. Hind tibia in female with a single proximal and a pair of terminal spurs, all of moderate length. Wing-shape and facies of *Acidalia*, distal margins smooth. Fore wing with SC^2 from cell, anastomosing with SC^1 and then very strongly with SC^{3-4} (*i. e.* areole double and SC^1 and SC^5 arising before and behind the apex of the distal areole), M^1 well separate from R^3. Hind wing with C normal, SC^2 very shortly stalked or almost connate with R^1, M^1 well separate from R^3.

Type of the genus: *Tricentroscelis protrusifrons*, sp. n.

Differs from the Neotropical *Scelolophia* Hulst (= *Calyptocome* Warr. = *Crypsitila* Warr.), which also has often a 3-spurred female hind tibia, in the protuberant face and longer cells.

TRICENTROSCELIS PROTRUSIFRONS, sp. n. (Pl. II. fig. 21, ♀.)

♀, 21 mm. Face fuscous. Palpus fuscous, not quite reaching extremity of frons. Vertex and antenna similarly coloured to wings, but rather paler; antennal ciliation minute. Thorax concolorous with wings. Abdomen slightly paler, 2nd–4th segments mostly occupied dorsally by a large fuscous blotch, the later segments interruptedly marked with fuscous dorsally. Fore wing with apex and termen somewhat rounded; reddish brown (light grey-brown irrorated with rufous and blackish); antemedian line indicated by rufous and blackish scales, accentuated by black spots on costa and hind margin and dots on the veins, arising before one-third costa, bent in cell, becoming oblique inwards and sinuous; discal dot small but sharp; median shade obsolescent, placed between discal dot and postmedian line, slightly more distinct as a costal dot, outbent at radials, inbent at fold; postmedian from costa slightly beyond two-thirds, faint except at costa and veins, where it is marked by black dots, angled at SC^5, then strongly oblique outwards to R^1, then more parallel with termen, but slightly sinuate inwards at R^2 and more strongly at fold; terminal dots strong, black; fringe somewhat dusted with blackish, a slender clear line at base. Hind wing with termen almost smooth, very slightly sinuous towards anal angle; concolorous with fore wing, discal dot slightly larger, median shade much stronger, nearly straight, proximal to the discal dot, antemedian wanting, the rest as on fore wing. Under surface slightly paler, the discal and terminal dots and postmedian line reproduced, though less sharp; hind wing in addition with median shade indicated at abdominal margin.

1909: Apr. 6,—1 ♀ (type).

Superficially similar to some African *Acidalia* (*exiguaria* group) or *Ptychopoda* (*sinuilinea* Prout, etc.).

TRAMINDA RUFISTRIGATA (Hmpsn.).

Ephyra rufistrigata Hmpsn. Proc. Zool. Soc. Lond. 1896, p. 267, pl. x. fig. 3.

1908: Sept. 28,—1 ♀. **1909**: Apr. 14,—1 ♀.

Described from Aden; distributed as far as British East Africa. As the male hind tibia has all spurs present, the species must be removed to *Traminda*.

TRAMINDA NEPTUNARIA (Guen.).

Timandra neptunaria Guen. Spec. Gén. Lép. x. p. 3, t. 18. fig. 5 (1858).

Timandra viridaria Walk. List Lep. Ins. Brit. Mus. xxiii. p. 800 (1861).

Gnamptoloma neptunaria Warr. Nov. Zool. ii. p. 95 (1895).

Traminda neptunaria Swinh. Tr. Ent. Soc. Lond. 1904, p. 562.

Mandera.—1909: Apr. 5,—1 ♂; Apr. 27,—1 ♀.

Hargaisa.—1908: Oct.,—1 ♂.

Widely distributed in Africa.

CHLORERYTHRA RUBRIPLAGA Warr.

Chlorerythra rubriplaga Warr. Nov. Zool. ii. p. 91 (1895).

1908: Sept. 19,—1 ♀; Oct. 25,—1 ♀. **1909**: Feb. 15,—1 ♀; Feb. 22,—1 ♀; Mar. 14,—1 ♂; May 10,—1 ♀. **1910**: Jan.,—1 ♀.

The male and two females (22 Feb. and 10 May) belong to the plain green form with the oblique red line almost entirely obsolete; the other four females have the line distinct, the ground-colour showing the three gradations well known in this group (green, green irrorated with rufous, rufescent). Doubtfully distinct generically from *Traminda*. Widely distributed in Eastern Africa.

ACIDALIA MINOA, sp. n. (Pl. II. fig. 20, ♀.)

♀, 20 mm. Unfortunately (like so many of the species) without the male, but showing sufficient peculiarities to render it safe to describe it. Absolutely without markings, very glossy, otherwise bearing a good deal of superficial resemblance to a worn female of *Minoa murinata* Scop., though with narrower wings; similarly coloured; the fore wing beneath with a smoky suffusion, which is also slightly indicated on the upper surface at certain angles of light. Head and body slightly more ochreous than wings, the face and palpus sharing this colour, not—as in the majority of *Acidalia*—black or fuscous. Abdomen rather robust. Venation rather variable, SC^1 of fore wing arising from just before apex of areole or well stalked with the other subcostals; C of hind wing not rapidly diverging from SC, sometimes anastomosing at slightly more than a point; SC^2 in two of the examples extremely shortly stalked with R^1. Termen of hind wing not at all bent in middle.

1909: Apr. 7,—1 ♀ (type); Apr. 9,—1 ♀: Apr. 23,—1 ♀.

I suspect this may prove to belong to the less specialized section *Pylarge* (male hind tibia with terminal spurs).

ACIDALIA MINORATA (Bsd.).

Geometra (*Idea*) *minorata* Bsd. Nouv. Ann. Mus. Hist. Nat. ii. p. 263 (1833).

? *Acidalia remotata* Guen. Spec. Gén. Lép. ix. p. 458 (1858).

Acidalia consentanea Walk. List Lep. Ins. Brit. Mus. xxii. p. 745 (1861).

? *Acidalia actuaria* Walk. ibid. p. 752 (1861).

? *Acidalia derasata* Walk. ibid. xxvi. p. 1604 (1862).

1908: July 17,—1 ♀; Sept. 11,—2 ♀; Sept. 13,—1 ♀; Sept. 25,—1 ♀; Sept. 30,—1 ♀; Oct. 11,—1 ♀; Oct. 20,—1 ♀; Nov. 24,—1 ♀. **1909**: Jan. 12,—2 ♀; Oct. 20,—2 ♀; Oct. 29,—1 ♀; Nov. 16,—1 ♀.

All fifteen females referable, so far as present knowledge is available, to this very common, very widely distributed, and moderately variable species. On an average, the lines are less crenulate and more concise than in the most typical forms, and as there is some slight variation in the breadth of the wings, as well as in the tone of colour and strength of markings, I am not prepared to say that there may not be two or three species mixed. One or two examples, in the sparseness of their irroration, recall *lactaria* Walk. (List Lep. Ins. xxii. p. 744), which, however, is possibly also only an aberrant form of *minorata*. Distributed throughout Africa, except, perhaps, the extreme north-west; also eastward to Aden and, if *actuaria* is really the same species, to India and Ceylon.

ACIDALIA SPOLIATA Walk. (?).

Acidalia spoliata Walk. List Lep. Ins. Brit. Mus. xxii. p. 744 (1861).

1908: Nov. 22,—1 ♀.

The single example is of the *minorata* group, larger than that species, somewhat less reddish and more marked than *internataria* Walk. (List Lep. Ins. xxii. p. 746), very likely a deeply coloured form of *spoliata* Walk. (from S. Africa), or, perhaps, a form of the widely distributed Oriental species, *nesciaria* Walk. (List Lep. Ins. xxii. p. 750).

ACIDALIA HORIOCHRŒA, sp. n.

♀, 20–23 mm. Face blackish. Palpus white beneath, dark-mixed above. Vertex white. Collar pale ochreous. Thorax, abdomen, and legs concolorous with wings, fore femur and fore tibia infuscated above. Fore wing of medium breadth, with apex moderately pointed; dirty white, irrorated (variably in strength in the different individuals) with brown-grey; lines moderately

strong, though resolving themselves under the lens into condensed irroration; antemedian slender, generally indistinct anteriorly, oblique outwards from one-third costa, strongly recurved in cell, oblique inwards to about one-fourth hind margin, faintly sinuous; discal dot small but sharp; median line thicker than the others, well beyond discal dot, very strongly oblique outwards from costa, very sharply bent subcostally, thence very slightly obliquely inwards and sinuous, the sinuosities being, as usual, at the folds, but never very deep, sometimes scarcely appreciable; postmedian fine, midway between median and termen or slightly nearer to the former, parallel with termen except at costa, where it makes a bend, though less sharply than the median, sinuosities slight or very slight; subterminal indicated by absence of irroration, accompanied proximally by a band of stronger irroration, distally by a *band of browner tone*, sometimes partly obscured by the grey irroration, but always noticeable, usually clearest anteriorly, not rarely showing a bright brown, almost ferruginous spot near apex; a narrow white line separates this band from the terminal line, which is black, thickest between the veins, slightly interrupted at the veins and *extends round the apex* for some distance along the costa, as in the *submutata* group; fringe with a line of stronger irroration beyond the middle, distally hereto less strongly irrorated than proximally. Hind wing with termen not bent at R^3; first line absent; median just proximal to discal dot, obsolete anteriorly; postmedian slightly sinuous, nearly parallel with termen; distal area nearly as on fore wing, the brownish band fading out at apex instead of becoming more conspicuous, the terminal line not extended round apex; fringe as on fore wing. Under surface more weakly marked, that of fore wing somewhat suffused basally, that of hind wing whiter; first line and sometimes median shade obsolete or nearly so.

1908: Aug. 24,—2 ♀. **1909**: Jan. 16,—1 ♀; Jan. 19,—1 ♀; Feb. 18,—1 ♀; Feb. 19,—1 ♀; Apr. 22,—1 ♀; May 10,—1 ♀; May 29,—1 ♀; Aug. 17,—1 ♀; Sept. 17,—1 ♀ (type); Dec. 30, —1 ♀. **1910**: Jan. 8,—1 ♀; Jan. 12,—1 ♀.

A very distinct though unostentatious little species, recognizable especially by the characters printed in italics.

ACIDALIA (PYLARGE) NEPHELOPERAS, sp. n.

♂, 16–23 mm.; ♀, 19–23 mm. Superficially like *Glossotrophia romanaria* Mill., and *rufomixtata* Rbr., but structurally an *Acidalia* of the section *Pylarge*. Best described by a comparison with the well-known *A. submutata* Tr., with which it entirely agrees in the markings (though these are, on an average, more sharply expressed), including the continuation of the black terminal line round the apex, and the tendency (sometimes very strong) to blue-grey clouding in the distal area. Much smaller; ground-colour varying from ochreous whitish to reddish sand-colour (much as in *pulchellata* Fab.), antennal ciliation in both sexes longer, male hind tibia with a pair of spurs, face pale in lower

half, termen of fore wing slightly more curved, of hind wing not subcrenulate; terminal line accompanied proximally by a fine whitish line (as in *pulchellata*), and on the fore wing expanded into a large triangular dot anteriorly to SC^5, fringe more strongly dark-dotted than in *submutata*; under surface glossy, that of hind wing scarcely paler than that of fore wing, discal dots rarely quite obsolete, fore wing generally with noticeably darkened border distally.

1908: Feb. 13,—1 ♀; Sept. 15,—1 ♂; Sept. 22,—1 ♀; Nov. 13,—1 ♀. **1909**: Jan. 12,—1 ♀; Jan. 20,—1 ♀; Feb. 18,—1 ♂; Mar. 24,—1 ♂ (type); Apr. 14,—1 ♀.

There is also a male from Port Sudan (*Mrs. E. N. Waterfield*) in coll. Brit. Mus., and a larger one from Bhuj Kutch (*Lt.-Colonel C. G. Nurse*).

Rather variable in colour and in the strength of the markings. Related to *Acidalia* (*Pylarge*) *ocellicincta* Warr. (Nov. Zool. viii. p. 9), from British East Africa.

Acidalia pulchellata Fab.

Phalena pulchellata Fab. Ent. Syst. iii. (2) p. 171 (1794).

Acidalia addictaria Walk. List Lep. Ins. Brit. Mus. xxii. p. 749 (1861).

Craspedia addictaria Hmpsn. Faun. Ind., Moths, iii. p. 429 (1895).

?*Craspedia rufinubes* Warr. Nov. Zool. vii. p. 91 (1900).

1908: May 4,—1 ♂. **1909**: Mar. 24,—1 ♀; Apr. 24,—1 ♀; May 6,—1 ♀. **1910**: Mar. 18,—1 ♀.

Mostly of a more ruddy form than the Indian. The British Museum collection has one quite similar from Aden.

Acidalia timia, sp. n. (Pl. II. fig. 19, ♀.)

♀, 21–26 mm. Face blackish fuscous, very narrowly pale-edged beneath. Palpus fuscous above, pale beneath. Antenna (as in *nepheloperas*) unusually strongly ciliated for a female, the cilia fully one-half as long as diameter of shaft. Vertex, thorax, and abdomen concolorous with wings; collar ochreous. Fore femur darkened on upper side. Fore wing with apex not very sharp, termen straight anteriorly, gently curved posteriorly, not extremely oblique; palest fleshy ochreous, rather glossy (similar to *beckeraria* Led., but still paler), without dark irroration, but in places slightly clouded with less whitish fleshy-ochreous; antemedian and median lines (or narrow shades) ochreous, very feeble, sometimes almost entirely obsolete, the former sometimes marked with darker dots on SC, M, and SM^2; discal dot usually distinct, sometimes elongate, placed on the median shade; post-median line fine and faint, but marked with fuscous dots on the veins (a larger one at costa), shaped about as in *beckeraria*; darker ochreous, fuscous-dotted spots or patches commonly follow the postmedian between the radials and at posterior margin; terminal line ochreous, very feeble, especially posteriorly; fringe

concolorous, in strongly marked specimens with dark ochreous or even fuscous-mixed dots. Hind wing with termen smooth; concolorous with fore wing, discal dot and postmedian row of dots present, the latter followed by a not very strong band of ochreous shading. Under surface glossy, slightly less pale ochreous (especially the fore wing), without markings.

1908: Mar. 24,—1 ♀; Aug. 15,—1 ♀; Sept. 26,—1 ♀. **1909**: Jan. 14,—1 ♀; Jan. 20,—1 ♀; Apr. 16,—1 ♀; Apr. 20,—1 ♀; May 8,—1 ♀; Oct. 7,—1 ♀ (type). **1910**: Jan. 8,—1 ♀.

Apart from the colour, and the presence of dark cloudings distally to the postmedian line, this neat little species differs from *beckeraria* in having the termen of the fore wing, on an average, less oblique.

Acidalia pyrrhochra, sp. n. (Pl. II. fig. 18, ♀.)

♀, 23–25 mm. Structure of the preceding. Face blackish fuscous (in all three examples badly abraded below). Shape and essential markings of *timia*, of which it might possibly be an extraordinarily different colour-form, unconnected with the name-type by any transitions. Strongly rufous ochreous, as in *fulvicolor* Hmpsn. (Nat. Hist. Socotra, p. 331), or the most rufous aberration of *nepheloperas* Prout, in two of the examples finely irrorated with blackish, in the other more uuiform; in place of the two ochreous patches which characterize *timia* there is a continuous black-grey clouding proximally to the dentate subterminal line (which is, in consequence, distinctly expressed), and some slighter shading distally to the same—altogether recalling certain forms of *marginepunctata* Goeze, *nepheloperas* Prout, etc., more than *timia*. Under surface rather paler than upper, the distal cloudings faintly indicated in greyish.

1908: Oct. 30,—1 ♀ (type). **1909**: Apr. 9,—1 ♀; Nov. 16, 1 ♀.

The last-mentioned (the example without blackish irroration) is further aberrant in having the distal cloudings extremely weak, the discal dot of the fore wing surrounded by an ill-defined deeper reddish spot, that of the hind wing very minute. Easily distinguished from the reddest form of *nepheloperas* by the absence of black terminal line and triangular subapical dot, etc.

Acidalia luridata (Zell.).

Idæa luridata Zell. Isis, 1847, p. 20 (*nec* Stgr.).

Acidalia cœnosaria Led. Verh. zool.-bot. Ver. Wien, v. p. 209, t. 3. fig. 3 (1855) (ab.).

Acidalia luridata Prout, Seitz Macrolep. iv. p. 64, t. 4 *e* (1913).

1908: July 31,—1 ♀; Aug. 25,—1 ♀. **1909**: Jan. 12,—1 ♀; Feb. 22,—1 ♂; May 8,—1 ♂; Sept. 18,—1 ♀; Oct. 24,—1 ♀.

Fairly typical, *i. e.* rather darker than, and not quite so reddish as, the form *cœnosaria* Led., which is the more general in S. Europe and Asia Minor. The distribution of the species

extends from Greece and Northern Egypt to Zerafshan and N.W. India, and the British Museum has an example from Yemen, Arabia, but the present specimens extend its known range in Africa.

ACIDALIA SAGITTILINEA (Warr.).

Craspedia sagittilinea Warr. Nov. Zool. iv. p. 219 (1897).

1909 : Feb. 15,—1 ♂ ; Feb. 16,—1 ♂ ; Feb. 17,—1 ♂.

Described from Mombasa, and I have seen a few from other localities in British East Africa. Both these Somaliland examples are rather less strongly marked (especially beneath), the median shade faint, placed midway between discal dot and post-median line.

GLOSSOTROPHIA DISPARATA SOMALIATA, subsp. n.

♀, 17–19 mm. Name-typical *disparata* Hmpsn. (Nat. Hist. Socotra, p. 332, *Craspedia*) has never been described, its recognition hitherto depending on a good, though uncoloured figure (ibid. t. 20. fig. 18), and a note by Rebel (Denks. Akad. Wien. Math.-nat. Kl. lxxi. 2, Sep. p. 69) to the effect that it belongs to the *confinaria* group of *Acidalia* (i. e. *Glossotrophia* Prout), and that the male antenna might almost be called shortly pectinate (*i. e.* subdentate with fascicles of cilia). It is the smallest of the genus; male hind tibia with one spur, hind wing slightly less regularly rounded than in the typical species (slightly bent at R^3); sand-colour with dense dark irroration, not "fluted" as in *romanaria* Mill., terminal line (except towards apex) broken into very short, strong dashes, at and round apex fine and less pronounced than in most of the species. *Face concolorous.* Palpus dark-mixed on outer side. Tongue moderately long. Subsp. *somaliata* (bon. sp.?) is rather larger, fore wing slightly longer, irroration much lighter, showing a feeble tendency towards the "fluting"; terminal dashes more slender and less black, apical line somewhat more pronounced. Palpus with less dark spotting on outer side.

1908 : Sept. 14,—1 ♀. **1909** : Jan. 11,—1 ♀ (type).

ZYGOPHYXIA TORNISECTA, sp. n.

♂, 14 mm.; ♀, 16–19 mm. Face and palpus fuscous. Tongue slender, rather short. Antennal ciliation in male moderately long. Vertex white. Collar white, with a slight ochreous tinge. Thorax, abdomen, and legs concolorous with wings. Hind tibia in both sexes with terminal spurs. Wings less narrow than in *relictata* Walk. (the type of the genus); fore wing only slightly, hind wing decidedly, narrower than in *elongaria* Rbr., which in some respects it rather recalls; hind wing with shallow, rounded excision from M^2 to tornus, inner margin consequently shortened. Dirty white with a tinge of brownish, and with moderately strong fine brown-grey irroration; discal dots small, black; lines generally not sharply defined (in the male particularly weak),

those of the fore wing approximately parallel with the termen, the slender antemedian and broad (sometimes strong) postmedian perhaps slightly more oblique and with a strong proximal bend at costa, the median touching the distal edge of the cell-dot, postmedian slender, proximal subterminal broad, distal subterminal very weak; first line of hind wing absent, median shade rather straight, except the sharp anterior bend; termen with black dots between the veins; fringe dusted with fuscous, most thickly opposite the veins, a fine pale line at its base, a broader one just beyond the middle. Underside similar or more blurred.

1908: Aug. 15,—1 ♀. **1909**: Feb. 28,—1 ♂ (type); Mar. 24, —1 ♀; Apr. 15,—1 ♀.

Ptychopoda subtorrida, sp. n. (Pl. II. fig. 17, ♀.)

♀, 18 mm. Face and palpus black. Vertex, antenna, thorax, abdomen, and fore leg concolorous with wings (other legs lost). Fore wing rather narrow; light ochreous brown, almost entirely suffused with vinous, less so basally and costally; scattered black irroration; lines black; antemedian from one-fourth costa, oblique outwards, very acutely angled in cell, then equally oblique inwards to behind M, thus forming a **V**-mark, a second, much shorter angle outwards at fold, but the entire posterior half of the line less strong, more dissolved into coarse black dots; median line from mid-costa, sinuous in **S**-shape, the anterior (outward) curve crossing the deep-black cell-spot; postmedian from costa at nearly three-fourths, forming an inward curve or bend at first, sharply angled outwards at R^1 (forming a shorter **V** than the antemedian), weakly incurved between the radials and boldly between M^1 and SM^2, finally oblique inwards at hind margin; distal area with blackish cloudings, the most conspicuous being one at R^1 (interrupted at the position of the obsolete subterminal line) and a longitudinally elongate pair on either side of M^1; no terminal line; fringe very long, its proximal half light ochreous brown, opposite the veins with amorphous spots formed of groups of black dots, distal half paler and somewhat greyer, unmarked. Hind wing rather narrow, with termen almost smooth, not very strongly convex; more strongly irrorated than fore wing, especially at base; first line not developed; median thick and somewhat diffuse, proximal to the sharp black cell-spot; postmedian as on fore wing, but with the angle at R^1 less pointed; distal area with two somewhat sinuous bands of dark irroration, enclosing a pale subterminal line; fringe as on fore wing. Under surface considerably paler, costal margin of fore wing finely dark-dusted, the rest rather smooth and glossy; both wings with strong discal spot (larger than above) and a moderately strong outer line, starting from a slightly enlarged spot at costa which corresponds to the origin of the postmedian of upper surface, but oblique outwards, bent about R^1, thence approximately parallel with termen, corresponding to the proximal subterminal dark shade of the hind wing above; fringe unspotted.

1909: Mar. 24,—1 ♀ (type).

Near *torrida* Warr. (Nov. Zool. xi. p. 468), termen of hind wing less protuberant, antemedian line more acutely angled, not connected with median by dark shading, under surface more strongly marked.

Ptychopoda nigrosticta Warr. (?).

Ptychopoda nigrosticta Warr. Nov. Zool. iv. p. 61 (1897).

1908: Feb. 24,—1 ♀ (rather worn).

The large discal dots and the markings, so far as they can be made out, suggest the more mottled forms of this species, but the former are perhaps somewhat exaggerated, the wings are rather more coarsely dusted, with stronger dark markings near the termen, the underside with the cell less infuscated and with the spot near the tornus apparently wanting. Described from Natal and occurs in the Transvaal and, perhaps, British East Africa, but it is by no means certain that these more northerly specimens belong here: they may be slightly narrower winged. Good specimens, and especially the male, must be awaited.

Ptychopoda sp.

1908: Aug. 26,—1 ♀. Rather rubbed.

Probably new, unless it be a form of *subpurpurata* Stgr. (from Syria, etc.). Rather uniform reddish sand-colour, very weakly marked: fore wing with traces of a strongly sinuous darker median line, hind wing with fine, strongly sinuous postmedian line; both these lines marked with some fuscous dusting.

Ptychopoda aperta, sp. n. (Pl. II. fig. 16, ♂.)

♂, 17 mm. Face dark fuscous. Palpus short and slender, dark fuscous. Tongue slight. Antennal ciliation scarcely longer than diameter of shaft. Head, body, and legs about concolorous with wings; fore leg fuscous above; abdomen dorsally belted with fuscous. Fore wing with all the subcostals on a common stalk, through suppression of distal wall of areole (base of SC^{3-5}); brown with a tinge of reddish and with rather coarse blackish-fuscous irroration, mainly longitudinal in direction; base more strongly irrorated costally; first line ill-defined, bent, becoming oblique inwards, with some black marking near costa; median shade also ill-defined (especially in anterior half), strongly sinuous, the proximal curve in submedian area being rather deep; postmedian line well expressed, from a black spot at two-thirds costa to one at about three-fourths hind margin, forming a slight outward curve from SC^5 to M^2 and a stronger submedian inward curve, marked throughout with small dark dashes on the veins; some broad, vague, irregular dark shading between this and termen; fringe with large black spots opposite the veins. Hind wing with termen somewhat sinuate towards tornus: M^1 separate at its origin from R^3; concolorous with fore wing, the median

and postmedian lines strongly expressed; distal area and fringe as on fore wing. Under surface paler; fore wing very weakly marked, only the postmedian line showing, and that faintly; hind wing with median and postmedian lines, though much weaker than above; fringes with the dark spots present, but weaker than above.

1909: Jan. 13,—1 ♂ (type).

In some respects similar to *Pt. semilinea* Warr. (Nov. Zool. iii. p. 314), from the Khasia Hills. Remarkable for the subcostal venation of the fore wing, which is like that of *Chrysocraspeda* and almost unique in *Ptychopoda*; I know of only one species which shares the peculiarity, namely *marginata* Swinh. (Tr. Ent. Soc. Lond. 1894, p. 182), unless *chrysocilia* Hmpsn. (Ill. Het. viii. p. 124) is also a *Ptychopoda*; in any case none of the three has any connection with *Chrysocraspeda*, which has strongly pectinate male antenna, hind tibia with four spurs, cell of hind wing short, etc.

Subfam. Larentiinæ.

Pseudosterrha philæaria (Brabant).

Sterrha philæaria Brabant, Bull. Soc. Ent. Fr. 1896, p. 384.

Pseudosterrha gayneri N. Rthschd. Nov. Zool. viii. p. 433 (1901); xii. t. 4. fig. 10 (1905).

1908: Sept. 16,—1 ♀.

Described from Egypt. I suspect, however, it is merely a form of—or even entirely synonymous with—*Ps. paullula* Swinh. (Proc. Zool. Soc. Lond. 1886, p. 456), from India.

Euphyia (Camptogramma) natalata (Walk.).

Scotosia natalata Walk. List Lep. Ins. Brit. Mus. xxv. p. 1681 (1862).

Scotosia rubritincta Hmpsn. Bull. Liverp. Mus. ii. p. 38 (1899).

Hargaisa.—1908: Oct. —1 ♂.

Widely distributed in East Africa, also Socotra.

Subfam. Geometrinæ.

Heterostegane indularia (Guen.).

Stegania indularia Guen. Spec. Gén. Lép. x. p. 46 (1858).

Mandera.—1908: Apr. 27,—1 ♂; May 2,—1 ♀; May 28,—1 ♀; June 1,—2 ♂, 4 ♀; June 18,—1 ♂; June 29,—2 ♂; July 8,—1 ♂; July 17,—1 ♂; July 24,—1 ♂; July 31,—1 ♂; Sept. 13,—3 ♂, 1 ♀; Sept. 14,—1 ♂; Sept. 17,—2 ♂; Sept. 22,—1 ♂; Sept. 24, 4 ♂, 1 ♀; Sept 26,—2 ♂, 1 ♀; Oct. 1,—1 ♂. **1909**: Mar. 24,—1 ♀; Apr. 8,—1 ♂; May 10,—1 ♀. **1910**: Mar. 2,—1 ♀.

Hargaisa.—1908: Oct.,—1 ♂.

The series from Mandera shows the usual range of variation in ground-colour and intensity of markings, but nearly all are of small size.

The male from Hargaisa may perhaps be referred to ab. *calidata* Warr. (Nov. Zool. iv. p. 78), though the ground-colour remains pale; all three lines are strongly developed; possibly a distinct species, as the palpus looks a little stronger and the antennæ (unfortunately damaged) may have less long ciliation.

Described from Abyssinia, but extends through eastern Africa to the Cape.

ZAMARADA SECUTARIA (Guen.).

Stegania secutaria Guen. Spec. Gén. Lép. x. p. 45 (1858).
Zamarada pulverosa Warr. Nov. Zool. ii. p. 158 (1895).

Mandera.—1908 : Sept. 23,—1 ♂.

Hargaisa.—1908 : Oct.,—1 ♂.

Both are small, the Hargaisa example rather worn, but apparently more weakly dusted than usual.

This species is likewise distributed from Abyssinia to the Cape.

OSTEODES PROCIDATA Guen., subsp. ERITREËNSIS Prout.

Osteodes procidata Guen. Spec. Gén. Lép. x. p. 177 (1858).
Osteodes turbulentata Guen. ibid. (1858).
Aspilates semispurcata Walk. List Lep. Ins. Brit. Mus. xxvi. p. 1679 (1862).

Gan Libbah.—1908 : June 24,—1 ♂. **1909** : Nov. 4,—1 ♀.

Both with the dark borders strong (subsp. *eritreënsis* Prout, Nov. Zool. xxii. p. 348, described from Eritrea).

Distribution as in the two preceding. Warren (Nov. Zool. ix. p. 529) apparently regarded Guenée's two forms (from Abyssinia and the Cape) as separate species, but Guenée's descriptions and the material before me suggest that Swinhoe (Tr. Ent. Soc. Lond. 1904, p. 504) is correct in uniting them.

DISCALMA SUBCURVARIA (Mab.).

Tephrina subcurvaria Mab. Ann. Soc. Ent. Fr. lxvi. p. 278 (1897).

Hargaisa.—1908 : Oct.,—1 ♂.

This species, apparently common throughout East Africa from Abyssinia to Natal, and originally described as from West Africa, has been mixed in our British collections with *observata* Walk. (List Lep. Ins. xxiii. p. 963) from the Cape, but I doubt the correctness of this; the latter, apart from its much darker and rather more reddish colour, has the median shade of the fore wing more oblique and the postmedian line rather further from the termen.

DISCALMA PUERILIS, sp. n. (Pl. II. fig. 15, ♂.)

♂, 16 mm. Face apparently without projecting cone of scales. Antennal joints scarcely projecting, the cilia scarcely as long as diameter of shaft. Head, body, and legs concolorous with wings; hind tibia dilated, with long hair-pencil, tarsus rather short.

Fore wing with fovea slight, SC^{1-2} coincident, touching C at a point; dirty white irrorated with brown-grey, leaving clearer a slight, ill-defined antemedian band (at least towards hind margin), a fairly broad but exceedingly ill-defined band just distally to the cell-dot and especially a broad, somewhat sinuous subterminal line, from costa at less than 1 mm. before apex to tornus, slightly dark-shaded proximally, especially at costa and hind margin; a small discal dot near costa at middle; a slightly darkened terminal line, interrupted at the veins; fringe pale (whitest proximally), traversed in middle by a fine grey line and cut throughout its length by brown-grey spots opposite the veins. Hind wing with termen almost smooth (scarcely waved); similar to fore wing, but with pale band-like markings scarcely indicated, subterminal line not quite so conspicuous as on fore wing; no discal dot; indications of a dark spot (end of a line) about middle of inner margin. Under surface similarly but more faintly marked; discal dot of fore wing absent.

1910: Feb. 14,—1 ♂ (type).

A very distinct though modest little species; it may be pictured by imagining a miniature edition of the North American "*Sciagraphia*" *nubiculata* Pack., exceedingly washed-out, dark lines of hind wing absent; structure as in that species, wings slightly narrower.

DISCALMA CALVIFRONS, sp. n. (Pl. II. fig. 14, ♂.)

♂, 17–20 mm. Face rather protuberant, rough, almost scaleless, with small horny prominences at upper and again at lower edge. Palpus rather short, rough-scaled, grey mixed with fuscous, 3rd joint very small and blunt. Antenna with joints projecting, the ciliation about as long as diameter of shaft, arranged in very slender even fascicles. Thorax and abdomen concolorous with wings, the patagia in front more fuscous. Hind tibia with hair-pencil. Fore wing with fovea; not broad, the termen being rather straight and moderately strongly oblique; SC^{1-2} coincident, sometimes free, sometimes slightly connected or anastomosing at a point with one or both of the adjacent veins; white-grey, irrorated with brownish fuscous; discal dot black, variable in size; lines fuscous, irrorated more or less with blackish, sometimes sharply dark at costa; antemedian from nearly one-fourth costa, oblique outwards, strongly angled in front of M, then oblique inwards to M, here sometimes marked with a blackish dot, then running perpendicularly to hind margin, occasionally with a very slight curve inwards; median line very variable in strength and thickness, usually crossing, sometimes just proximal to, the discal dot, almost straight except for a small proximal bend at costa; postmedian from before three-fourths costa, vertical or (oftener) slightly oblique outwards, curved or angled at R^1, thence about parallel with termen, marked with blackish vein-dots, sinuate inwards in submedian area and slightly oblique outwards at hind margin; distal area (at least in its proximal half) clouded with

dark grey, with a distinct, sinuous, whitish, subterminal line, which is rather thick in places, and especially widens at costa so as almost to reach apex; proximally to the subterminal an irregular blackish spot between R^3 and M^1, sometimes also anteriorly to R^3; termen with a row of moderately thick blackish dashes; fringe weakly dark-chequered opposite the veins. Hind wing with termen almost perfectly rounded, sometimes with a slight suggestion of prominence at R^3 and sinuosity in front of the same; similar to fore wing, without the antemedian line. Fore wing beneath somewhat more suffused from base to median shade; discal dot weak; the shade between postmedian and subterminal strengthened into a dark band, without the blackish spot, the subterminal itself obsolete; band between median and postmedian lines, also the posterior half of distal area (or at least a patch behind R^3) somewhat whiter than above. Hind wing beneath whitish, with median shade, discal dot and outer band distinct. Female, on an average, rather larger, rather broader-winged, sometimes more suffused, lines generally weak (except the costal spots), distal dark shade extended to termen, usually almost obliterating the subterminal line except costally, where the subapical pale spot persists, at least in part, black spot proximally to subterminal line between R^3 and M^1 seldom developed; the hind wing and under surface show corresponding differences.

1908: Sept. 14,—1 ♂; Sept. 24,—1 ♂; Sept. 28,—1 ♂; Oct. 14, —1 ♀; Oct. 15,—1 ♂; Oct. 24,—1 ♂ (type). **1909**: Apr. 10,—2 ♀; Apr. 14,—1 ♂; Apr. 22,—1 ♀; Apr. 27,—1 ♀; May 10,—1 ♀; May 12,—1 ♀.

Variable both individually and (in particular) sexually. More recalls certain tropical American species (e. g. *Macaria nigricomma* Warr. in the case of the male, *heliothidata* Guen. in that of the female) than any African species with which I can compare it. Scarcely a true *Discalma*.

MACARIA SEMIALBIDA Prout.

Macaria semialbida Prout, Nov. Zool. xxii. p. 351 (1915).

1908: June 21,—1 ♂.

Antenna broken, but a remnant shows that the ciliation is scarcely as long as the diameter of the shaft. Hind tibia strongly dilated. Fovea strong.

Founded on females from British East Africa.

MACARIA OBLIQUILINEATA (Warr.).

Gonodela obliquilineata Warr. Nov. Zool. vi. p. 307 (1899).

Semiothisa obliquilineata Swinh. Tr. Ent. Soc. Lond. 1904, p. 507.

1908: May 4,—2 ♀. **1909**: Mar. 14,—1 ♂; Apr. 11,—1 ♀; May 10,—1 ♀; Nov. 10,—1 ♀.

Rather variable, on an average slightly smaller than the

examples (Abyssinia, White Nile, British East Africa) in the British Museum, postmedian line of fore wing rather more curved at costa. In the fore wing veins SC^{1-2} are coincident, in three examples free, in three slightly connected with C.

TEPHRINA INCONSPICUA Warr.

Tephrina inconspicua Warr. Nov. Zool. iv. p. 113 (1897).

1908: July 2,—1 ♀; Aug. 24,—1 ♀.

Rather weakly marked, especially the hind wing, which appears rather more whitish than in the normal form (Natal to Nyassaland); but it is not in quite perfect condition. In the fore wing the costal end of vein C is obsolete, leaving it to appear that C and SC^1 are coincident throughout, anastomosing shortly with SC^2. A worn female from Arabia (coll. Brit. Mus.) appears to agree with the Somaliland example, though larger and with normal venation; thus the species seems to be widely distributed.

TEPHRINA BUTARIA (Swinh.).

Semiothisa butaria Swinh. Tr. Ent. Soc. Lond. 1904, p. 510.

1909: May 8,—1 ♂.

Known from Central and East Africa and as far north as Abyssinia.

TEPHRINA NETTA (Holland).

Grammodes netta Holland, in Donaldson-Smith, Through Unknown African Countries, p. 418, fig. 9 (1897).

1908: July 1,—1 ♂; July 31,—1 ♀; Sept. 21,—1 ♀; Sept. 26, —1 ♀. **1909**: May 21,—1 ♀; July 8,—1 ♀; Aug. 17,—1 ♂.

As I understand Sir George Hampson has compared Holland's type, I accept the determination of the species at the British Museum, which possesses a single example from Abyssinia. The fore wing agrees well with Holland's figure, but the hind wing has distal borders nearly as in *Discalma subcurvaria* Mab., or even more extended to the termen. Male antenna bipectinate.

TEPHRINA CINERASCENS (Btlr.).

Acidalia cinerascens Btlr. Ann. Mag. Nat. Hist. (4) xvi. p. 418 (1875).

Ematurga bilineata Warr. Nov. Zool. ii. p. 129 (1895).

Tephrina cinerascens Swinh. Tr. Ent. Soc. Lond. 1904, p. 511.

1909: May 10,—1 ♀. Rather worn, weakly marked.

Distributed from the Cape to British East Africa, and doubtfully distinct from *pumicaria* Led. (Syria) and *fumosa* Hmpsn. (India). The large, strongly marked Abyssinian form figured by Guenée (Phal. t. 17. fig. 7) is unknown to me.

TEPHRINA DISPUTARIA (Guen.).

Eubolia disputaria Guen. Spec. Gén. Lép. x. p. 489 (1858).

Tephrina disputaria Hmpsn. Faun. Ind., Moths, iii. p. 209 (1895).

Mandera.—**1908**: June 1,—1 ♀; June 29,—1 ♀; July 5,—1 ♀; July 17,—1 ♀; Aug. 24,—3 ♀; Sept. 13,—1 ♀; Sept. 19,—1 ♀; Sept. 26,—1 ♂, 1 ♀; Oct. 12,—1 ♀. **1909**: Jan. 18,—1 ♀; Jan. 19,—1 ♀; Mar. 12,—1 ♀; Mar. 19,—1 ♀; Apr. 7,—1 ♀; Apr. 22,—1 ♀; Aug. 17,—1 ♂, 2 ♀; Oct. 5,—1 ♀; Nov. 9,—2 ♀. **1910**: Mar. 2,—1 ♀; Mar. 6,—1 ♀. Year ?: Feb. 25,—1 ♀.

Hargaisa.—**1908**: Oct.,—4 ♂.

Extremely variable, occurring probably throughout the year, though none was taken in February or December. The great majority of the females belong to the form *subocellata* Warr. (Nov. Zool. iii. p. 413), described from S. Othman, Arabia. I follow Swinhoe in considering *subocellata* to be a form of the variable *disputaria* Guen. Two of the males are small, with the distal part of the median area almost free from dark dusting, the postmedian line more than usually bent. A few females are also small, but otherwise normal. Two females are smooth-scaled, the distal area broad, inclining to violet-grey, the black marks on hind margin of fore wing and those distally to the middle of the postmedian line very sharply prominent.

Described from Egypt, but widely distributed in North and East Africa, Arabia, India, etc.

TEPHRINA DEERRARIA Walk.

Tephrina deerraria Walk. List Lep. Ins. Brit. Mus. xxiii. p. 962 (1861); Swinh. Tr. Ent. Soc. Lond. 1904, p. 510.

Mandera.—**1908**: Oct. 15,—1 ♀. **1909**: Apr. 7,—1 ♀; Apr. 10,—1 ♀; Apr. 22,—1 ♀; May 10,—1 ♀; Oct. 7,—1 ♂; Oct. 11,—1 ♂. **1910**: Jan. 8,—1 ♀.

Buggan.—**1908**: June 27,—1 ♂.

In one female the discal spot of the fore wing is reduced, scarcely forming an ocellus. Generally larger than the preceding, less brown, postmedian line straighter, otherwise hard to distinguish; perhaps a form of the same. Distributed from the Cape to Abyssinia.

TEPHRINA PRIONOGYNA, sp. n. (Pl. II. fig. 13, ♀.)

♀, 28–33 mm. Antenna strongly serrate, the serrations of the outer series so long as to form rudimentary pectinations. Fore wing with SC^1 out of C, free or anastomosing at a point with SC^2, SC^2 in one example anastomosing at a point with SC^{3-4}. Otherwise extremely like strongly irrorated females of the preceding *; discal mark of fore wing reduced to a small weak dot, median shade usually absent, antemedian line of fore wing more strongly curved, postmedian curving anteriorly (both variable in distinctness), terminal dots weaker or obsolete, the dark distal border beneath extended to the termen, or else becoming

* In *disputaria* and *deerraria* SC^{1-2} are coincident, often anastomosing at a point or slightly connected with SC^{3-4}. Even if this difference prove not absolutely constant, it is at least general.

uniformly lighter there, no tendency towards the *central* pale terminal patches which are general in *deerraria*, termen of hind wing smooth (in *disputaria* often slightly more undulate).

1909: Apr. 15,—1 ♀; May 9,—1 ♀; May 10,—3 ♀ (including type).

Cœnina tergimacula, sp. n. (Pl. II. fig. 12, ♂.)

♂ ♀, 24 mm. Face ochreous, lower half with a large fuscous spot on each side. Palpus with 3rd joint short, ochreous mixed with fuscous. Male antennal pectinations long and reaching to near apex—beyond three-fourths (female without head). Vertex, thorax, and abdomen concolorous with wings, abdomen with a dark fuscous dorsal blotch anteriorly. Fore wing narrow, costa and termen almost straight, hind margin somewhat convex, in female sinuous; SC^2 connected by bar with SC^{3-4}, R^3–M^1 stalked (sometimes rather long-stalked); pale ochreous whitish, irrorated and suffused, especially at base and half-way along costa, with purple-grey; a brown or fuscous stripe from beyond middle of costa, oblique outwards, strongly curved or angled between R^1 and R^2, oblique inwards (and forming a very slight proximal curve) to middle of hind margin; a faint, oblique antemedian line or shade usually indicated, another midway between postmedian and termen, bearing in its anterior part two or three darker wedge-shaped spots, the one before R^1 the strongest and blackest; fringe spotted with fuscous. Hind wing narrow, especially in female, tooth at end of SC^2 in female very acute and produced, termen in male weakly, in female more strongly, toothed at R^3, anal angle scarcely produced; concolorous with fore wing or rather more brightly and sharply marked; a broad, dark, olive-brown, fuscous-mixed, somewhat sinuous band from inner margin near anal angle to costa near apex, finely white-edged distally, the white broadening anteriorly. Under surface similar, the markings weaker and more diffuse.

1908: Oct. 3,—1 ♂. **1909**: Apr. 7,—1 ♂; Apr. 12,—1 ♂ (type); Sept.,—1 ♀.

Genus Sesquialtera, nov.

Face slightly prominent, convex, with moderately appressed scales. Palpus moderate, rather stout, rough-scaled, terminal joint short. Tongue short. Antenna in male (?); in female slightly subserrate, with very minute ciliation. Pectus and femora moderately hairy. Hind tibia with terminal spurs only. Fore wing long and narrow (greatest breadth—mid-costa to tornus—three-eighths of length), costa nearly straight, apex rather sharp, termen, except close to apex, extremely oblique, slightly curved, very faintly sinuous, rather longer than hind margin; tornus very weak; cell short, less so at its extremities, DC^2 being oblique inwards and DC^3 extremely oblique outwards; SC^{1-2} long-stalked, SC^1 sometimes anastomosing with C, SC^2 connected by a

bar with SC^{3-4} about opposite the origin of SC^5, SC^{3-5} long-stalked from just before end of cell, SC^{3-4} separating near apex; radials normal; M^1 long-stalked with R^3, M^2 arising rather near end of cell. Hind wing only about half the length of fore wing, costal margin strongly concave, termen with long projecting teeth at SC^2 and R^3, otherwise sinuous rather than dentate, tornus moderate; cell about one-half, DC incurved; C approximated (but not appressed) to SC to near end of cell, then moderately diverging; SC^2 from close to end of cell; R^2 absent; R^3–M^1 long-stalked, M^2 from very near end of cell.

Type of the genus: *Sesquialtera ridicula*, sp. n.

SESQUIALTERA RIDICULA, sp. n. (Pl. II. fig. 11, ♀.)

♀, 32–36 mm. Head, body, and fore wing fuscous with darker irroration. Fore wing extremely weakly marked, a darker cell-mark and a postmedian line indicated, the latter remote from termen, strongly excurved at radials; sometimes also a vague, diffuse, oblique, somewhat curved antemedian line or shade indicated. Hind wing variable, in the type with the basal area blackish fuscous, the rest more concolorous with fore wing, but traversed by ill-defined ferruginous-brown bands, in other examples more uniform, the base being less blackened, the ferruginous scales largely suppressed; a blackish discal dot, crossed or closely preceded by the more or less sinuous antemedian (median) line and followed by a distinct postmedian (darker brown or blackish) sinuate inwards between radials and in submedian area; a brown or black terminal line. Under surface similar to upper, in the type less variegated in hind wing.

1909: May 12,—1 ♀ (type).

Also in Hope Department, Oxford, from British East Africa, 5 May, 1913, c. 1° S., 35° E., 5000–6000 feet, forest with open glades (*H. B. Popplewell*), 1 ♀. Also from Mt. Kenya in Paris Museum.

PACHYPALPIA SUBALBATA Warr.

Pachypalpia subalbata Warr. Nov. Zool. vii. p. 98 (1900).

1908: Oct. 25,—1 ♀.

Described from British East Africa. Known also from German East Africa.

ASCOTIS SELENARIA (Schiff.).

Phalæna Geometra selenaria [Schiff.] Schmett. Wien, p. 101 (1775).

Ascotis selenaria Hbn. Verz. Bek. Schmett. p. 313 (1826).

Trigonomelea semifusca Warr. Nov. Zool. xi. p. 475 (1904).

1909: May 10,—1 ♂.

Extraordinarily widely distributed in S. and E. Europe, Asia, and Africa.

Fam. SATURNIDÆ.

EPIPHORA ATBARINUS Butl.

1909: Oct. 14,—1 ♂, 2 ♀.

LUDIA HANSALI Feld.

1908: Oct. 29,—1 ♀. **1909**: Sept.,—1 ♀. Year?: Apr. 27, —1 ♂ (B.M.).

Fam. ARBELIDÆ.

SELAGENA EUSTRIGATA, sp. n. (Pl. II. fig. 27, ♂.)

♂. Head and thorax white tinged with rufous, the dorsum of thorax with long spatulate chocolate-brown scales; antennæ with the branches rufous; pectus and legs white, the latter with brown mixed; abdomen white, the 2nd segment with dorsal tuft of long spatulate rufous and chocolate-brown scales, the anal tuft tinged with rufous and with spatulate black-brown scales mixed. Fore wing creamy white, with fine dark brown pencillings with white bars on them defined by black and leaving the veins white below base of costa, from medial part of cell to inner margin, in end of cell, between veins 5 and 2 to near termen, and forming a wedge-shaped subterminal patch between veins 8 and 6; a white patch with some rufous before and beyond it beyond the discocellulars, and a white spot with some rufous before and beyond it below vein 2 near its origin. Hind wing silvery white. Underside white; fore wing with the cell and area beyond it to near termen suffused with brown with some white striæ on it; hind wing with some red-brown striæ on medial part of costa.

1908: Sept. 13,—1 ♂ (type); Sept. 14,—1 ♂ (B.M.); Sept. 18,—1 ♂; Sept. 20,—1 ♂; Sept. 26,—1 ♂; Oct. 6,—1 ♂. **1909**: Sept.,—2 ♂. *Exp.* 20–24 millim.

SELAGENA ATRIDISCATA Hmpsn.

1909: Oct. 5,—1 ♀.

METARBELA DIODONTA, sp. n. (Pl. II. fig. 28, ♂.)

♂. Head and thorax dark reddish brown mixed with some grey-white, the frons whiter; palpi black-brown; pectus and legs red-brown mixed with some whitish; abdomen white tinged with brown and with chocolate-brown dorsal streaks at base and extremity, the anal tuft tipped with chocolate-brown. Fore wing white tinged with brown; a series of black-brown points below the costa; a black-brown subbasal point on median nervure with a slight dentate dark brown line from beyond it to inner margin; a very irregular patch of brown suffusion defined by black-brown on medial part of inner margin, indented above and below by white spots towards its extremity; a down-curved black-brown streak from middle of cell to lower angle with a point beyond it in the cell and an irregular oblique bilobate mark defined by black-brown in upper extremity of cell; an oblique strongly

dentate dark line from below apex to inner margin at the medial patch with more prominent blackish teeth between veins 7 and 5 and some dark suffusion beyond it; a terminal series of geminate black points. Hind wing silvery white with a very faint brownish tinge and faint brownish terminal line. Underside white with a faint brownish tinge and series of small brown spots on costa of fore wing.

♀. Abdomen more suffused with brown; fore wing more suffused with brown, the streak in lower end of cell absent and the oblique dentate postmedial line very indistinct; hind wing strongly tinged with brown.

1908: Sept. 27,—1 ♂; Sept. 28,—1 ♂; Sept. 29,—1 ♂; Oct. 1,—1 ♂; Oct. 4,—1 ♀ (type); Oct. 11,—1 ♂ (type); Oct. 14,—1 ♂ (B.M.); Oct. 20,—1 ♂; Oct. 23,—1 ♂; Oct. 24,—1 ♂. **1909**: Sept.,—1 ♂. *Exp.* 22–26 millim.

Metarbela perstriata, sp. n. (Pl. II. fig. 29, ♀.)

♀. Head, thorax, and abdomen grey-white suffused with reddish brown. Fore wing creamy white, thickly irrorated with dark reddish brown and with numerous rather reticulate lines, formed by dark reddish-brown striæ and with obscure dark brown spots at middle and end of cell. Hind wing and underside whitish suffused with brown.

1908: Sept. 27,—1 ♀ (type). *Exp.* 22 millim.

Arbelodes rufula Hmpsn.

1909: Mar. 14,—1 ♂; Apr. 8,—1 ♂; May 10,—1 ♂.

Fam. Cossidæ.

Azygophleps inclusa Wlk.

1909: May 13,—1 ♀.

Duomitus mesosticta, sp. n. (Pl. II. fig. 30, ♂.)

♂. Head, thorax, and abdomen white mixed with dark brown, the metathorax almost entirely black-brown; palpi and tarsi black-brown. Fore wing white irrorated with reddish brown, the medial inner area with a shade formed by thicker irroration, extending before middle to above vein 1; a discoidal patch formed by similar irroration conjoined beyond lower angle of cell to a similar shade on terminal area, the cell, submedian interspace except on terminal area, and an oblique postmedial shade from costa whiter; elliptical black-brown medial spots above and below vein 1; cilia chequered dark brown and white at tips. Hind wing white, the cilia chequered with dark brown to vein 2. Underside of fore wing with the inner area white with a brown spot below middle of cell; hind wing with the costal area irrorated with brown.

1908: Apr. 29,—1 ♂; May 4,—1 ♂ (B.M.); Sept. 12,—1 ♂. **1909**: Oct. 7,—1 ♂ (type). *Exp.* 28–38 millim.

DUOMITUS STENIPTERA, sp. n. (Pl. II. fig. 31, ♂.)

♂. Head and thorax white mixed with red-brown and some black, the metathorax almost entirely black-brown; antennæ dark brown; tarsi black ringed with white; abdomen whitish suffused and irrorated with red-brown. Fore wing white with sparse strong black striæ, the inner area tinged with rufous to beyond middle; a wedge-shaped black-brown patch on costal area from base to near middle; a rather triangular black spot below end of cell with its upper extremity somewhat produced; a black-brown patch at end of cell extending to the costa; some small black spots on costa towards apex; a subterminal series of small more or less distinct clavate dark marks in the interspaces; cilia chequered reddish brown and white. Hind wing white, the cilia with some brown scales mixed. Underside white; fore wing with small black spots on costa and blackish spot below end of cell, the terminal area striated with brown; hind wing with the costal area finely striated with red-brown.

1908: Apr. 27,—1 ♂ (type). **1909**: May,—1 ♂. *Exp.* 28–38 millim.

DUOMITUS SIMILLIMA, sp. n. (Pl. II. fig. 32, ♂.)

♂. Head and thorax dark red-brown mixed with some whitish and black, the metathorax entirely black-brown; antennæ dark brown; tarsi black ringed with white; abdomen dark red-brown mixed with whitish at sides towards base. Fore wing grey-white suffused with red-brown and sparsely striated with strong black striæ, slighter on basal area, the medial area from costa to vein 1, the postmedial area from costa to vein 2, and the interspaces of terminal area whiter; a rather triangular black spot below the cell; subterminal series of slight clavate dark marks in the interspaces; cilia chequered dark brown and greyish. Hind wing whitish suffused with brown, the cilia obscurely chequered with dark brown. Underside of fore wing suffused with brown, the terminal area striated with brown, series of small black spots on costa and below terminal part of cell; hind wing whitish, the costal area suffused with brown, the costa towards apex and termen with some brown striæ.

1908: Sept. 20,—1 ♂ (type); Sept. 23,—1 ♂. *Exp.* 24–28 millim.

Fam. LASIOCAMPIDÆ.

TRICHIURA OBSOLETA Klug.

1908: Oct. 25,—1 ♂; Oct. 29,—1 ♂. **1909**: Mar. 14,—2 ♂; Apr. 8,—2 ♂; Apr. 11,—1 ♀; Apr. 15,—1 ♀; Oct. 14,—1 ♂, 1 ♀; Dec. 30, 1 ♂. **1910**: Jan. 2,—1 ♂; Mar. 10,—1 ♀; Mar. 13,—1 ♂.

ANADIASA SIMPLEX Pag.

1909: Apr. 8,—1 ♂.

CHILENA DONALDSONI Holl.

1908: Oct. 13,—1 ♂. **1909**: Feb. 20,—1 ♂; Mar. 26,—1 ♂; Mar. 29,—1 ♂; Apr. 1,—1 ♂; Apr. 5,—1 ♂; Apr. 6,—1 ♀; Apr. 10,—4 ♂; Apr. 14,—1 ♂; Apr. 20,—1 ♂. **1910**: Mar. 20, —1 ♂.

Fam. LIMACODIDÆ.

CŒNOBASIS CHLORONOTON, sp. n. (Pl. II. fig. 35, ♂.)

♂. Head and thorax emerald-green; antennæ fulvous yellow; palpi fulvous yellow, brownish at sides; tibiæ on inner side and the tarsi fulvous yellow, the tarsi with brown points on outer side; abdomen pale orange-yellow, the sides and ventral surface whitish at base. Fore wing emerald-green, the costal edge orange-yellow. Hind wing white tinged with emerald-green, especially towards termen; the cilia emerald-green. Underside of fore wing with the costal half fulvous brown, the inner half greenish white, the termen and cilia green; hind wing pale orange-yellow, the terminal area tinged with green; the cilia green.

1908: Oct. 12,—1 ♂. **1909**: Apr. 4.—1 ♂ (type); Apr. 8, —2 ♂ (1 in B.M.); Apr. 9,—1 ♂; Apr. 10,—1 ♂; Apr. 20, —1 ♂; Apr. 23,—1 ♂; Apr. 24,—1 ♂ (B.M.); Sept.,—1 ♂. *Exp.* 18–20 millim.

CŒNOBASIS FULVICORPUS Hmpsn.

1908: Sept. 26,—1 ♂; Oct. 24,—1 ♂. **1909**: Apr. 4,—1 ♂; Apr. 5,—1 ♂; Apr. 7,—3 ♂; Apr. 8,—2 ♂, 1 ♀.

Genus FEATHERIA, nov.

Type, *F. obvia.*

Proboscis absent; palpi obliquely upturned, short, not reaching to middle of frons, which is smooth; antennæ of male bipectinate with moderate branches to apex, of female with short branches; metathorax with spreading crest; tibiæ with the spurs moderate, the hind tibiæ with the medial spurs present; abdomen with rough hair at base of dorsum. Fore wing with the apex rounded, the termen evenly curved; veins 2, 3 shortly stalked, 5 from near angle; 6 from well below upper angle; 7 from just below angle; 8, 9 stalked; 10, 11 from cell. Hind wing with veins 3 and 5 from near angle of cell; 6, 7 stalked; 8 from middle of cell.

FEATHERIA OBVIA, sp. n. (Pl. II. fig. 33, ♂.)

♂ ♀. Head and thorax grey-white mixed with reddish brown; tarsi ringed with white; abdomen grey-white tinged with red-brown. Fore wing grey-white tinged in parts with reddish brown and irrorated with dark brown; a dark brown point at lower angle of cell, with an oblique brown line from it to inner margin slightly defined on outer side by whitish followed by a reddish-brown shade; an oblique dark-brown fascia from apex meeting the shade beyond the medial line, slightly incurved below vein 7,

where there is a more or less elongate black spot beyond it, the oblique fascia followed by a whitish shade arising below apex; a terminal series of black-brown striæ. Hind wing white suffused with reddish brown; a fine darker brown terminal line and fine white line at base of cilia. Underside white tinged with reddish brown, the costal areas irrorated with brown.

Mandera.—1908: July 16,—1 ♂; Aug. 16,—1 ♂; Sept. 26, —2 ♂, 1 ♀; Sept. 27,—1 ♀ (type). **1909**: Mar. 24,—1 ♂ (type); Apr. 9,—1 ♂; Sept. 6,—1 ♀.

Gan Libbah.—1908: June 26,—1 ♀. *Exp.* ♂ 22, ♀ 28 millim.

Paryphanta fimbriata Karsch (arcuilinea B.-B.).

1909: Mar. 26,—1 ♂; Apr. 10,—1 ♂.

Scotinochroa minor, sp. n. (Pl. II. fig. 34, ♂.)

♂. Head, thorax, and abdomen bright chestnut mixed with fulvous yellow and some dark brown; antennæ fulvous. Fore wing bright chestnut irrorated with dark brown and rough silvery scales; an obscure dark mark below origin of vein 2; the postmedial area ochreous whitish with a very ill-defined band of dark and silvery scales, rather maculate to lower angle of cell, then excurved; a curved maculate subterminal band of dark and silvery scales from below costa to vein 2; a dark brown patch at apex. Hind wing yellow tinged with rufous, the cilia deeper rufous at tips. Underside yellow, the fore wing suffused with rufous, the hind wing tinged with rufous.

1909: Apr. 20,—1 ♂ (type). *Exp.* 18 millim.

Gavara leucomera, sp. n. (Pl. II. fig. 36, ♀.)

♀. Head, thorax, and abdomen white, faintly tinged with rufous; fore tibiæ and the tarsi pale brown ringed with white. Fore wing white tinged with rufous except on terminal area, which is slightly irrorated with rufous; a rather oblique rufous antemedial shade from below costa to inner margin; a black point at lower angle of cell; an indistinct waved rufous line from lower angle of cell to inner margin; an indistinct sinuous rufous line from middle of costa to submedian fold above tornus, then incurved to inner margin; a distinct diffused rufous line from costa beyond middle to termen at submedian fold, excurved at middle; a terminal series of rufous striæ. Hind wing white tinged with rufous; a fine rufous terminal line; cilia white. Underside white, the fore wing suffused with rufous, the hind wing tinged with rufous.

1909: Apr. 8,—1 ♀ (type). *Exp.* 16 millim.

Fam. Thyrididæ.

Rhodoneura hamatipex, sp. n. (Pl. II. fig. 37, ♂.)

♂. Head, thorax, and abdomen ochreous suffused with rufous. Fore wing ochreous tinged with rufous and thickly reticulated

with rufous striæ, browner at costa; a slight antemedial line forking towards costa and forming a slight fork towards inner margin; a narrow rather oblique postmedial band formed by two lines filled in with rufous except towards costa, the inner line curved inwards to costa and somewhat angled inwards at lower angle of cell and vein 1, the outer line excurved below costa, the band somewhat constricted at submedian fold, a reticulate band formed of double striæ beyond it from vein 7 to tornus; an oblique double line filled in with rufous across apical area from costa to termen at vein 4. Hind wing ochreous tinged with rufous and striated with rufous lines; a slightly curved antemedial line, dark point just above lower angle of cell, darker slightly sinuous medial line, two or three faint postmedial lines, and a more prominent subterminal line oblique to discal fold, then sinuous to tornus. Underside of fore wing with a streak formed by black spots and opalescent silvery scales below middle of cell and a short streak formed by black dashes beyond upper angle, the medial part of postmedial band, the subterminal band towards tornus, and the oblique band except at costa prominently filled in with rufous.

1909: Apr. 11,—1 ♂; Oct. 19,—1 ♂; Oct. 30,—1 ♂ (type). *Exp.* 22 millim. Closely allied to *R. squamigera* Pag.

Fam. Pyralidæ.

Subfam. Crambinæ.

Ancylolomia pectinifera Hmpsn.

1909: Mar. 10,—1 ♀; Mar. 14,—1 ♀.

Surattha scitulellus Wlk.

1908: Sept. 18,—1 ♀; Sept. 20,—1 ♀; Sept. 21,—1 ♀; Sept. 22,—1 ♀; Sept. 24,—2 ♀; Sept. 26,—1 ♀. **1909**: Mar. 13,—1 ♀; Mar. 14,—1 ♀ (B.M.); Mar. 19,—1 ♀; Mar. 22, —1 ♀.

Surattha invectellus Wlk.

1908: Aug. 15,—1 ♂; Sept. 14,—1 ♂; Sept. 20,—1 ♂; Sept. 24, —1 ♂; Sept. 26,—1 ♀. **1909**: Feb. 15,—1 ♀; Feb. 16,—2 ♀; Feb. 23,—1 ♂; Mar. 5,—1 ♂; Mar. 11,—1 ♀ (B.M.); Mar. 13, —3 ♂, 4 ♀; Mar. 19,—1 ♂, 1 ♀ (♂ B.M.); Oct. 14,—1 ♀.

Subfam. Schœnobianæ.

Genus Calamoschœna, nov.

Type, *C. ascriptalis*.

Proboscis absent; palpi upturned, in male hardly reaching to middle of frons, in female to vertex of head; maxillary palpi minute; frons smooth, rounded; antennæ in both sexes laminate and almost simple; hind tibiæ with the outer medial spur minute. Fore wing with vein 3 from before angle of cell; 4, 5 shortly

stalked; 6, 7, 8, 9 stalked; 10, 11 from cell. Hind wing with veins 3 and 5 from angle of cell, 4 absent; 8 anastomosing with 7.

CALAMOSCHŒNA ASCRIPTALIS, sp. n. (Pl. II. fig. 38, ♂.)

♂. Head and thorax pale ochreous; pectus, legs, and abdomen ochreous white. Fore wing uniform pale ochreous. Hind wing glossy white, the cilia tinged with ochreous at base. Underside white; fore wing with the costal half tinged with ochreous.

♀. Head and thorax slightly tinged with rufous; abdomen more ochreous; hind wing with the termen and cilia at base tinged with ochreous.

1908: Oct. 6,—1 ♂ (type). **1909**: Oct. 12,—1 ♀ (type). *Exp.* ♂ 20, ♀ 28 millim.

Subfam. PHYCITINÆ.

STAUDINGERIA SUB-OBLITELLA Rag.

1909: Feb. 15,—1 ♀.

EUZOPHERA VILLORA Feld. (STRAMANTELLA Rag.).

1909: June 10,—1 ♀.

NEPHOPTERYX METAMELANA Hmpsn.

1908: Sept. 16,—1 ♀; Sept. 18,—1 ♂.

NEPHOPTERYX ? EMUSSATATELLA Rag.

1908: Sept. 14,—1 ♀.

NEPHOPTERYX EUGRAPHELLA Rag.

1909: Oct. 11,—1 ♀.

NEPHOPTERYX SERRATELLA Rag.

1908: Feb. 24,—1 ♀; Sept. 12,—1 ♀; Sept. 19,—1 ♀ (B.M.); Sept. 26,—1 ♀ (B.M.); Oct. 12,—1 ♀; Oct. 20,—1 ♀: Oct. 25, —1 ♂ (B.M.); Nov. 18,—1 ♀. **1909**: Jan. 9,—1 ♀ (B.M.); Mar. 13,—1 ♀; Apr. 16,—1 ♀ (B.M.); Dec. 31,—1 ♀.

Subfam. EPIPASCHIANÆ.

MACALLA PURPUREOPICTA, sp. n. (Pl. II. fig. 39, ♀.)

♀. Head and thorax pale grey; pectus, legs, and abdomen cupreous rufous, the last with some blackish at base of dorsum. Fore wing with large tufts of raised hair-like scales below the cell before middle and in middle and end of cell; pale greyish and white and with some dark irroration beyond the cell, the area below the cell and vein 3 purplish rufous from before middle to tornus; a blackish antemedial line from cell to inner margin, slightly angled outwards at submedian fold, the tufts of scales in the cell grey-brown; blackish streaks on middle of

vein 1 and basal half of veins 2 and 3, and a slight streak beyond upper angle of cell; an oblique black bar from origin of vein 7 to vein 5 near termen; a purplish-rufous patch on terminal part of costa with oblique purplish-rufous bar from it at vein 7 to vein 5 just before termen; a terminal series of dark striæ except towards tornus; cilia white tinged with rufous and with a pale brownish line near tips. Hind wing semihyaline white, the apical area suffused with red-brown to vein 4; a diffused purplish-red streak on terminal part of vein 2; a terminal series of red striæ, darker towards apex: cilia white, tinged with fiery red at base. Underside of both wings white, the costal and apical areas red.

1909: Apr. 9,—1 ♀ (type). *Exp.* 24 millim.

Subfam. Endotrichinæ.

Endotricha consobrinalis Zell.

Hargaisa.—1908: Oct.,—2 ♂.

Subfam. Pyralinæ.

Aglossa incultalis Zell.

1909: Feb. 17,—1 ♂.

Aglossa ommatalis Hmpsn.

1909: Mar. 8,—1 ♀.

Aglossa basalis Wlk.

1908: Sept. 17,—1 ♀; Sept. 24,—1 ♀; Sept. 26,—1 ♀; Sept. 30,—1 ♀. **1909**: Feb. 11,—1 ♀.

Tegulifera zonalis Warren.

1908: Nov. 3,—1 ♀.

Tegulifera nigricinctalis Hmpsn.

1908: Sept. 18,—1 ♂; Oct. 1,—1 ♀; Oct. 13,—1 ♀. **1909**: Apr. 14,—1 ♀; Apr. 22,—1 ♂.

Tyndis proteanalis Hmpsn.

1908: Aug. 24,—1 ♀; Aug. 27,—2 ♂; Sept. 3,—1 ♂: Sept. 12, —1 ♀; Sept. 15,—1 ♂; Sept. 16,—1 ♂; Sept. 18,—1 ♂, 1 ♀; Sept. 19,—1 ♂; Sept. 21,—1 ♂, 1 ♀; Sept. 22,—1 ♀. **1909**: Mar. 9,—1 ♀; Mar. 10,—1 ♀; Mar. 11,—1 ♂; Mar. 12,—1 ♂; Mar. 15,—3 ♂, 1 ♀; Mar. 18,—2 ♀; Mar. 19,—3 ♀; Mar. 20, —1 ♀; Mar. 21,—1 ♂, 1 ♀; Mar. 22,—4 ♀; Mar. 24,—1 ♀; Mar. 26,—2 ♀; Mar. 30,—1 ♂; Apr. 15,—1 ♀; Oct. 4,—1 ♀. Year ?: Sept. 25,—1 ♂.

Zitha subcupralis Zell.

1908: Aug. 24,—1 ♂. **1909**: Feb. 23,—1 ♂; Feb. 28,—1 ♂; Mar. 4,—1 ♂; Mar. 9,—1 ♂.

BOSTRA VARIANS Butl.

1908: Sept. 13,—1 ♀; Sept. 16,—3 ♀; Sept. 19,—1 ♀. **1909**: Mar. 26, 1 ♀; Apr. 8,—2 ♀; Apr. 10,—2 ♀; Apr. 14, —1 ♀; Apr. 20,—1 ♀.

BOSTRA TENEBRALIS Hmpsn.

1908: Sept. 14,—1 ♂; Sept. 15,—1 ♂; Sept. 19,—1 ♂.

BOSTRA PYROCHROALIS, sp. n. (Pl. II. fig. 43, ♀.)

♀. Head, tegulæ, and abdomen whitish tinged with red-brown; thorax fiery red. Fore wing fiery red slightly irrorated with whitish, the costal edge with some dark scales towards base and alternating whitish and dark brown points on medial area; antemedial line white, slightly excurved below costa, then inwardly oblique; postmedial line white, slightly excurved to vein 4, then slightly incurved; cilia purple-brown at base, the tips white with some red at apex. Hind wing white tinged with red-brown; the cilia purple-brown at base, white at tips.

1909: Mar. 24,—1 ♀ (type). *Exp.* 16 millim.

DATTINIA PERSTRIGATA, sp. n. (Pl. II. fig. 40, ♂.)

Antennæ of male bipectinate, with long branches to near apex.

♂. Head and thorax creamy white more or less tinged with brown; antennæ with the branches brown; palpi irrorated with blackish; abdomen creamy white with dorsal fulvous-yellow bands except at base and extremity, the anal tuft with pale blood-red subdorsal streaks. Fore wing with diffused blackish streaks below end of cell, above and below submedian fold and vein 1 to beyond middle, and on each side of veins 5 to 2; a small black spot in lower angle of cell and slight point in upper angle; the streaks partly interrupted by traces of a subterminal white line with blackish points before it on veins 7, 6; the costal half of wing sometimes irrorated with blackish; a terminal series of blackish points; cilia chequered with pale blood-red. Hind wing pure white and somewhat semihyaline.

Ab. 1. Fore wing with the streaks on each side of vein 1 and veins 5 to 2 beyond the cell with pale blood-red mixed, veins 7, 6 with pale blood-red streaks except on terminal area.

♀. Thorax strongly tinged with pale blood-red, the fore and mid tibiæ and tarsi suffused with blood-red, abdomen at sides and anal tuft blood-red; fore wing with the costa and cilia blood-red, diffused blood-red fasciæ above and below vein 1, the streaks on veins 7, 6 and on each side of veins 5 to 2 blood-red; an indistinct obliquely curved waved subterminal blood-red line between veins 7 and 1; hind wing suffused with brown, the veins towards termen and cilia suffused with blood-red; underside suffused with brown, the costal areas, veins towards termen, and cilia of both wings blood-red.

1908: July 1,—1 ♂; July 8,—1 ♂; July 19,—1 ♂; July 24, —1 ♂; Aug. 24,—1 ♀; Aug. 27,—1 ♂ (B.M.); Aug. 28,—1 ♂;

Sept. 21,—1 ♂; Sept. 23,—1 ♂; Sept. 24,—1 ♂; Sept. 26,—1 ♂ (type); Sept. 27,—1 ♂; Sept. 29,—1 ♂. **1909**: Jan. 18,—2 ♂, 1 ♀ (type); Mar. 14,—1 ♂, 2 ♀; Apr. 1,—1 ♂; Apr. 14,—1 ♂; May 12,—1 ♂; May 21,—2 ♂; Sept. 21,—1 ♂; Oct. 22,—2 ♂; Nov. 25,—1 ♀. **1910**: Mar. 6,—1 ♂; Mar. 9,—1 ♂; Mar. 10, —1 ♂; Mar. 12,—1 ♂ (B.M.). *Exp.* ♂ 36-40, ♀ 42 millim.

DATTINIA ORNATA Druce.

1908: Feb. 24,—1 ♂; Sept. 24,—1 ♀; Sept. 29,—1 ♀; Oct. 3,—1 ♂. **1909**: Mar. 14,—1 ♀; Mar. 18,—1 ♀; Mar. 19, —1 ♀; Mar. 26,—1 ♀; Apr. 16,—1 ♀; Oct. 8,—1 ♀; Oct. 11, —1 ♀.

DATTINIA PERATALIS, sp. n. (Pl. II. fig. 41, ♂.)

Antennæ of male bipectinate, with long branches to two-thirds length.

♂. Head, thorax, and abdomen ochreous tinged with rufous, the thorax deeper rufous; antennæ with the branches brown; frons and palpi deep rufous; legs red-brown, the tibiæ and tarsi ringed with whitish. Fore wing with the basal area rufous, the rest of wing silvery white with a creamy tinge suffused in parts with rufous; antemedial line creamy white defined on outer side by rufous and with some black irroration before it, slightly waved; the medial area mostly suffused with rufous, with a creamy-white patch in and beyond the cell extending to costa; an oblique black-brown discoidal bar and slight yellowish spot below end of cell; postmedial line creamy white defined on inner side by rufous, excurved to vein 3, then incurved, a patch of blackish scales beyond it at middle; a silvery whitish apical patch defined by rather diffused black scales. Hind wing ochreous white suffused with rufous; cilia with a white line at base followed by a rufous line. Underside whitish, the fore wing and costal area of hind wing suffused and irrorated with red-brown.

1909: Mar. 14,—1 ♂ (type). *Exp.* 14 millim.

DATTINIA COSTINOTALIS, sp. n. (Pl. II. fig. 42, ♂.)

Antennæ of male ciliated.

♂. Head, thorax, and abdomen grey mixed with reddish brown and fuscous, the vertex of head whitish; pectus whitish; tarsi brown ringed with white; abdomen blackish brown ventrally except towards base. Fore wing pale brownish grey slightly irrorated with blackish; the costal edge black towards base; subbasal line black defined on outer side by whitish, angled outwards below the cell and ending at vein 1; antemedial line black, oblique to below the cell, then incurved, a quadrate patch of blackish suffusion beyond it from costa to median nervure; a slight dark mark at lower angle of cell; postmedial line blackish, indistinct except towards costa, excurved to vein 4, then oblique and sinuous, an oblique black bar

beyond it from costa; a terminal series of slight brown spots; cilia brownish white with two fine brown lines through them. Hind wing semihyaline white; a fine brown terminal line and slight line through the cilia.

1908: July 31,—1 ♂ (type). *Exp.* 18 millim.

Cledeobia radialis Hmpsn.

1908: July 17,—1 ♀; July 24,—1 ♂. **1909**: Mar. 26,—1 ♀; Apr. 8,—1 ♂; Dec. 10,—1 ♀.

Subfam. Pyraustinæ.

Zinckenia fascialis Cram.

1908: Sept. 30,—1 ♀. **1909**: Jan. 11,—1 ♀; Jan. 13,—1 ♀; May 5,—1 ♂.

Sylepta sabinusalis Wlk.

1908: Feb. 24,—1 ♀. **1909**: Oct. 7,—1 ♀; Oct. 14,—1 ♀.

Glyphodes indica Saund.

1908: Oct. 27,—1 ♂. **1909**: May 14,—1 ♂.

Agathodes musivalis Guen.

1909: May 10,—1 ♀.

Crocidolomia binotalis Zell.

Berbera.—**1908**: Mar. 4,—1 ♂.

Hellula undalis F.

1909: Jan. 19,—1 ♀; Mar. 14,—2 ♀.

Sameodes ocellata, sp. n. (Pl. II. fig. 44, ♀.)

Fore wing with scale-tooth on inner margin before middle.

♀. Head white, the frons with rufous spot, the antennæ and palpi fulvous red; thorax fulvous red; pectus and legs white, the latter tinged with red-brown; abdomen white dorsally suffused with rufous. Fore wing fulvous red; a large rounded white patch with pale red centre from upper angle of cell to inner margin, its edges slightly waved and a similar but smaller patch beyond the cell connected with the costa and extending to vein 4. Hind wing pale rufous. Underside whitish suffused with rufous.

1908: May 28,—1 ♀; Sept. 19,—1 ♀ (type); Sept. 24,—1 ♀. *Exp.* 16 millim.

Leucinodes orbonalis Guen.

1908: Oct. 29,—1 ♀.

Nomophila noctuella Schiff.

1908: Nov. 13,—1 ♂.

PACHYZANCLA PHÆOPTERALIS Guen.

1908: Sept. 20,—1 ♀.

PACHYZANCLA BASALIS Wlk.

1908: Feb. 24,—1 ♀. **1909**: Apr. 10,—1 ♀.

PACHYZANCLA BIPUNCTALIS F.

1908: Sept. 30,—2 ♀; Nov. 24,—1 ♀.

PHLYCTÆNODES NUDALIS Hübn.

1908: Sept. 26,—1 ♀; Sept. 29,—1 ♀.

ANTIGASTRA CATALAUNALIS Dup.

1908: Sept. 18,—1 ♀.

NOORDA BLITEALIS Wlk.

1909: May 10,— 2 ♀.

MECYNA GILVATA F.

Mandera.—1908: Sept. 3,—1 ♂: Sept. 11,—1 ♂; Nov. 13,—2 ♀; Nov. 14,—1 ♀; Nov. 18,—1 ♂. **1909**: Jan. 14,—1 ♀; May 9,—1 ♀; Oct. 19,—1 ♂; Oct. 22,—2 ♂; Nov. 10,—1 ♀.
Gan Libbah.—1908: June 25,—1 ♂.

PIONEA MELANOSTICTALIS, sp. n. (Pl. II. fig. 46, ♂.)

♂ ♀. Head and thorax grey tinged with brown, the vertex of head white; palpi red-brown, white at base; pectus and legs mostly white, the fore tibiæ and tarsi brown ringed with white; abdomen grey-brown with white segmental rings, the ventral surface white. Fore wing whitish tinged and irrorated with brown, the costal area browner; small antemedial black spots on subcostal and median nervures, vein 1, and above inner margin; a black point in the cell towards extremity and discoidal bar; postmedial line black, dentate to vein 4, then with oblique bar to vein 2, then retracted to below end of cell and excurved at submedian fold and slightly above inner margin; a curved series of blackish points just before termen and a terminal series. Hind wing whitish suffused with red-brown; traces of a curved brown postmedial line; a terminal series of slight brown points; cilia white with a faint brown line near base.

1908: Sept. 23,—1 ♀; Sept. 27,—1 ♀, 1 ♂ (type); Oct. 11,—1 ♀ (B.M.); Nov. 24,—1 ♀. *Exp.* 16 millim.

PIONEA RUBRITINCTALIS, sp. n. (Pl. II. fig. 45, ♀.)

♀. Head and thorax ochreous yellow tinged with rufous; frons with white lines at sides; palpi white in front at base; pectus and legs white; abdomen reddish ochreous, the ventral surface white. Fore wing ochreous yellow tinged with rufous; traces of an oblique rather diffused rufous antemedial line; a more distinct

obliquely curved diffused rufous postmedial shade; cilia white at tips. Hind wing pale reddish ochreous with traces of a rather diffused curved rufous postmedial line.

1908: Sept. 24,—1 ♀. **1909**: May 10,—1 ♀ (type). *Exp.* 18 millim.

PYRAUSTA INCOLORALIS Guen.

1909: May 3,—1 ♀.

PYRAUSTA STHENIALIS, sp. n. (Pl. II. fig. 47, ♂.)

Mid tibiæ of male dilated with a fold containing a tuft of long hair, the hind tibiæ with the outer medial spur minute; abdomen very long with the anal tuft long.

Head, thorax, and abdomen pure white, the shoulders with grey stripes; frons and palpi towards tips tinged with grey. Fore wing semihyaline white; the costal area suffused with grey; oblique slightly curved grey postmedial and subterminal lines. Hind wing semihyaline white with faint curved greyish postmedial and subterminal lines.

1908: May 4,—3 ♂, 6 ♀; May 6,—1 ♀; May 28,—1 ♂; Sept. 29,—2 ♀ (1 in B.M.); Oct. 15,—1 ♀; Oct. 20,—1 ♂; Nov. 13,—2 ♂ (1 in B.M.); Nov. 18,—1 ♂ (type). **1909**: Apr. 16,—1 ♀ (B.M.). *Exp.* 22–24 millim.

PYRAUSTA CONISTROTALIS, sp. n. (Pl. II. fig. 48, ♀.)

♀. Head, thorax, and abdomen pale reddish brown tinged with grey, the vertex of head whitish; palpi rufous, white at base; pectus, legs, and ventral surface of abdomen white, the fore legs brown in front. Fore wing whitish tinged with reddish brown and thickly irrorated with dark brown, the costal area rather browner; antemedial line indistinct, dark, oblique towards costa, angled outwards at median nervure and vein 1 and incurved below the cell and above inner margin; a minute dark spot in the cell towards extremity and curved discoidal striga; postmedial line dark, waved, excurved from below costa to vein 3, then retracted to lower angle of cell and erect to inner margin; a terminal series of small dark spots; cilia with a dark line near base. Hind wing whitish suffused with brown especially on terminal area; an indistinct brown postmedial line, excurved from below costa to vein 2, where it is slightly angled inwards; cilia white with a dark line near base.

♂. Browner; fore wing with a faint purplish gloss.

1908: Oct. 23,—1 ♀ (type).

Also in B.M. from Br. E. Africa, N. Kavirondo, Maramas Distr., Ilala (*Neave*), 1 ♂. *Exp.* 22 millim.

SCELIODES LAISALIS Wlk.

1908: Sept. 26,—1 ♀; Nov. 13,—1 ♀. **1909**: Jan. 17,—1 ♀; Feb. 25,—1 ♀; Oct. 17,—1 ♀.

CORNIFRONS ALBIDISCALIS, sp. n. (Pl. II. fig. 49, ♂.)

Antennæ of male bipectinate with moderate branches to near apex; frontal prominence pointed at extremity, its lower edge produced to a point before extremity.

Head and thorax red-brown mixed with some white; antennæ ringed brown and white, the branches blackish in male; abdomen pale red-brown. Fore wing pale red-brown irrorated with darker brown especially on the veins; an oblique whitish shade from base of costa; a narrow white antemedial band defined by dark scales and with irregularly waved edges; a small rather elongate white spot defined by dark scales in middle of cell and a white discoidal bar also defined by dark scales, its lower extremity somewhat curved inwards; a narrow white postmedial band defined by dark scales and with minutely waved edges, angled inwards at veins 6, 3, 2 and outwards at submedian fold, excurved at middle and incurved to inner margin; a slight dark terminal line; cilia white at base followed by a dark line. Hind wing whitish suffused with brown especially in female; a slight brown spot at lower angle of cell and indistinct rather diffused curved subterminal line; cilia white with a brown line near base.

1908: May 4,—1 ♀; Sept. 28,—1 ♂ (type); Oct. 18,—1 ♂; Nov. 13,—1 ♀; Nov. 14,—1 ♂. **1909**: Apr. 5,—1 ♂; Apr. 7,—1 ♂, 2 ♀ (1 in B.M.); Apr. 10,—1 ♂. *Exp.* 20 millim.

TEGOSTOMA COMPARALIS Hübn.

1908: June 1,—1 ♀; Sept. 25,—1 ♀; Oct. 31,—1 ♀. **1909**: May 9,—1 ♂; May 10,—4 ♀.

TEGOSTOMA SUBDITALIS Zell.

1909: May 8,—1 ♂.

TEGOSTOMA BIPARTALIS Hmpsn.

1908: Aug. 15,—1 ♀.

NOCTUELIA GLOBULIFERALIS, sp. n. (Pl. II. fig. 50, ♂.)

♂. Head and thorax white mixed with rufous; palpi red-brown; fore tibiæ with brown bands near extremities; abdomen white with slight rufous dorsal bands and streaks on anal tuft. Fore wing white suffused with rufous; an indistinct rufous sub-basal line; antemedial line red-brown, excurved above inner margin, a round white spot defined by red-brown on its outer side in and below the cell; rounded white spots defined by red-brown in and below end of cell; a postmedial white patch defined by red-brown except above below the costa, intersected by a red-brown streak on vein 7 and its outer edge indented by a wedge-shaped red-brown mark on vein 6, a white patch beyond it at apex and oblique elliptical white spot defined by red-brown below it; a dark brown terminal line; cilia white at base with a brown line near base and brownish tips. Hind wing white: an elliptical

yellowish discoidal spot defined by brown and with brown line from it to above inner margin; a brown postmedial line from costa to vein 5 and elliptical white spot defined by brown between vein 5 and submedian fold; a dark brown terminal line; cilia with series of brown striæ near base and brownish tips.

1908: Oct. 29,—1 ♂ (type). *Exp.* 18 millim.

TINEINA.

By Jno. Hartley Durrant, F.E.S.

Olethreutidæ.

Eucosma Hb.

Eucosma somalica, sp. n.

Antennæ fuscous. *Palpi* whitish ochreous, more or less mixed with fuscous on the outer side of the median joint. *Head* and *thorax* whitish ochreous, slightly tinged with pink; tegulæ brownish fuscous, mixed with reddish. *Fore wings* elongate, slightly dilated posteriorly, male without costal fold, apex obtuse, termen nearly straight, slightly oblique; whitish ochreous, striate with fuscous and pinkish, with fuscous markings outlined by shining pearly scales; the markings, which appear more or less irrorate with whitish owing to some of the scales being tipped with white, consist of a basal patch, obtusely angled on the cell, and an irregular central fascia becoming attenuate, or even obsolete, toward the tornus, this fascia is outwardly connected with a subapical quadrate spot; the costa is strigulate with fuscous, there is also a fuscous apical spot and an interrupted terminal line; cilia whitish ochreous, with a pinkish gloss, traversed by two pale fuscous shade-lines. *Exp. al.* ♂ 18–27 ♀ mm. *Hind wings* with 3–4 stalked; fuscous; cilia whitish ochreous, traversed by two greyish fuscous shade-lines. *Abdomen* fuscous with paler transverse lines. *Legs* whitish ochreous; tarsi spotted with blackish.

Type ♂ (7248); ♀ (7249), Drnt. Det.

1908: Sept. 19,—1 ♂; Sept. 20,—1 ♀ (type); Oct. 24,—1 ♂ (type). **1909**: Jan. 20,—1 ♀. **1910**: Mar. 6,—1 ♀.

The female is a little darker than the male, the pearly scaling tending to become leaden, especially toward the tornus.

Tineidæ.

Nomima, gen. n.

(νόμιμος, η, ον = conventional.)

Type: *Nomima prophanes* Drnt.

Antennæ $\frac{5}{6}$, with projecting scales on each joint, giving a serrate appearance, and bipectinate 3, each pectination ciliate; basal joint without pecten. *Labial palpi* porrect, clothed beneath

and at end; terminal joint short, concealed. *Maxillary palpi* and *haustellum* obsolete. *Head* rough-haired. *Thorax* smooth—perhaps slightly tufted posteriorly. *Fore wings* elongate, rather narrow, apex round-pointed, termen rounded, surface with tufts of raised scales: *neuration* 12 veins, all separate; 7 to apex, 3–4 basally approximate; 1 furcate at base. *Hind wings* 1, elongate-ovate, with small transparent space below cubitus near base; cilia $\frac{1}{3}$: *neuration* 8 veins, all separate; 4–7 nearly parallel. *Abdomen* rather slender. *Legs*: posterior tibiæ long-haired above.

NOMIMA PROPHANES, sp. n.

Antennæ fuscous. *Palpi* yellowish ochreous. *Head* and *thorax* dark brownish fuscous; face yellowish ochreous. *Fore wings* cream-ochreous, with a dark brownish fuscous basal patch, and with a rather broad patch of the same colour commencing before the tornus and extending around the termen to the apex; the whole wing is ornamented with glistening spots of raised scales arranged in transverse lines—these raised spots have some admixture of bluish leaden-metallic, especially on the dark patches, and on the ochreous part of the wing transverse lines of pale greyish scaling occur between them; cilia shining, dark brownish fuscous with a purplish gloss, cream-ochreous along their base and above the apex; underside suffused with fuscous, except on a yellowish ochreous apical patch. *Exp. al.* 21–25 mm. *Hind wings* shining, pale grey with brassy sheen, more or less suffused with dark fuscous above and beneath in some specimens; cilia pale yellowish ochreous. *Abdomen* yellowish ochreous, dusted with fuscous. *Legs* yellowish ochreous, tarsi tinged with fuscous.

Type ♂ (7253), Drnt. Det.

1908: Sept. 30,—1 ♂. **1909**: Apr. 10,—1 ♂ (type); Apr. 15, —1 ♂.

ACHTHINA, gen. n.

(ʼαχθεινός, ή, όν = irksome.)

Type: *Achthina ctenodes* Drnt.

Antennæ ♀ bipectinate 2; basal joint without pecten. *Labial palpi* rather short, upcurved; terminal joint very short. *Maxillary palpi* and *haustellum* obsolete. *Head* rough. *Thorax* smooth. *Fore wings* with costa straight, apex round-pointed, termen and tornus evenly rounded: *neuration* 12 veins; 7–8 stalked, 8–9 stalked enclosing apex, 10 out of stalk of 7–9; 4–5 closely approximate, connate or short-stalked; 3 from angle, 2 at least twice as far from 3 as 3 is from 4; 1 basally furcate. *Hind wings* 1, rather short and broad, apex and tornus bluntly rounded: *neuration* 8 veins; 3–5 approximate, 2 remote from 3, 5 bent over and closely approximate to 4, or 4–5 stalked; 6–7 stalked or separate; media to below 6. *Abdomen*: female moderate, ovipositor exserted. *Legs*: hind tibiæ long-haired above.

The male is at present unknown, and there is some variation in

the neuration, but the pectinate antennæ and exserted ovipositor of the female distinguish this genus from its allies.

ACHTHINA CTENODES, sp. n.

Antennæ and *palpi* cinereous. *Head* and *thorax* cinereous with some admixture of fuscous. *Fore wings* cinereous, with some admixture of whitish, clearly and distinctly, but irregularly strigulate with blackish, to the number of about 12 or 13 complete lines, some reduplicate in part and with paler intermediate lines; cilia cinereous with a fuscous line near their base, and another toward their tips. *Exp. al.* 20 mm. *Hind wings* fuscous; cilia with a pale line near their base. *Abdomen* fuscous. *Legs* cinereous.

Type ♀ (7256), Drnt. Det.

1908: Sept. 18,—1 ♀; Sept. 27,—1 ♀ (type).

MELASINA Bdv.

MELASINA PSEPHOTA, sp. n.

Antennæ whitish ochreous, spotted with fuscous; male pectinate 5. *Palpi* moderate, densely scaled; whitish ochreous mixed with dark fuscous. *Head* whitish ochreous. *Thorax* whitish mixed with dark fuscous; with a dark fuscous tuft posteriorly. *Fore wings* elongate, costa somewhat arched, apex obtuse, termen obliquely rounded, with 12 veins, all separate; chalky white, strigulate and shaded with fuscous, and with the transverse markings more or less continuously edged with blackish; a fuscous basal patch, slightly angulate outward on the fold, is edged with dark fuscous except on the costa and dorsum, there is however a dark costal spot before the end of the patch with some trace of dark spots crossing the wing; at one-third from the base a more or less irregular, outwardly oblique, fuscous fascia crosses the wing, generally widening out from the costa and narrowing below the fold, with outward extension above the fold in the direction of a dark fuscous spot at the end of the cell, occurring on an oblique fuscous fascia extending, more or less conspicuously, from costa to tornus—in some specimens this fascia is connected with a fuscous costal patch preceding the apex; cilia chalky white, with two fuscous parting lines more or less interrupted by four or five whitish bars. *Exp. al.* ♂ 21–24 mm., ♀ 34 mm. *Hind wings* pale fuscous; cilia whitish, with a fuscous line near their base. *Abdomen* fuscous; female with long exserted ovipositor. *Legs* pale fuscous; anterior and median tarsi barred with dark fuscous.

Type ♂ (7260); ♀ (7261), Drnt. Det.

1909: Jan. 19,—1 ♂; Feb. 16,—1 ♂; Feb. 17,—1 ♂; Feb. 19, —1 ♂; Feb. 20,—1 ♂; Feb. 21,—1 ♂; Feb. 22,—1 ♂; Feb. 27,—1 ♂; Mar. 9,—1 ♂; Mar. 10,—1 ♂; Mar. 13,—2 ♂; Mar. 14,—1 ♀ (type); Mar. 20,—1 ♂; Mar. 26,—1 ♂ (type).

Closely allied to *recondita* Drnt., but the hind wings are distinctly broader and the termen is more erect above vein 3, where there is a slight angle, not noticeable in *recondita* which has the wings narrower and more pointed.

Horace Knight del et lith. West, Newman chr.

SOMALILAND LEPIDOPTERA.

Melasina reconditia, sp. n.

Antennæ pale fuscous; male pectinate 5. *Palpi* moderate, densely scaled; pale fuscous. *Head* pale fuscous. *Thorax* whitish cinereous mixed with dark fuscous; with a dark fuscous tuft posteriorly. *Fore wings* elongate, rather narrow, termen oblique; whitish cinereous, strigulate with blackish, and with pale fuscous markings more or less continuously edged with blackish; a basal patch is indicated by fuscous suffusion; on the costa at one-third commences an irregular pale fuscous fascia, contracted (sometimes interrupted) on the cell, thence widening, but becoming narrow from the fold to the dorsum; this fascia is connected to a pyriform costal patch of the same colour by a larger pyriform patch on the disc with some extension toward the tornus—these markings usually reach to the costa before the apex, but are sometimes disconnected; a rather conspicuous discal spot, irregular in outline, occurs at the end of the cell on the fuscous patch, below a small, oblong, dark-margined fuscous patch; cilia whitish cinereous, with seven or eight broad fuscous bars beyond a narrow fuscous dividing line. *Exp. al.* ♂ 22–27 mm.; ♀ 33–39 mm. *Hind wings* fuscous; cilia whitish, with a fuscous line along their base. *Abdomen* fuscous; female with long exserted ovipositor. *Legs* cinereous: tarsi barred with fuscous.

Type ♂ (7275); ♀ (7276), Drnt. Det.

1909: Mar. 9,—1 ♂; Mar. 10,—2 ♂ (including type); Mar. 11, —1 ♂; Mar. 12,—2 ♂; Mar. 13,—5 ♂; Mar. 15,—1 ♂; Mar. 17, —1 ♂; Mar. 18,—1 ♂; Mar. 19,—1 ♂, 1 ♀ (type); Mar. 21,—1 ♂; Mar. 26,—2 ♀. **1910**: Mar. 16,—1 ♂.

EXPLANATION OF THE PLATES.

Plate I.

Fig.
1. *Estigmene griseata* ♀.
2. *Secusio somaliensis* ♀.
3. *Chloridea albivenata* ♀.
4. *Thalatha melanostrota* ♂.
5. *Matopo heterochroa* ♂.
6. *Acroriesis ignifusa* ♀.
7. *Odontoretha featheri* ♂.
8. *Athetis discopuncta* ♀.
9. „ *ectomelæna* ♂.
10. *Ethiopica ignecolora* ♀.
11. „ *phæocausta* ♀.
12. *Pachycoa olivacea* ♀.
13. *Rabila albiviridis* ♂.
14. *Acrapex albicostata* ♂.
15. *Euterpiodes pictimargo* ♂.
16. „ *croceisticta* ♂.
17. *Paratuerta nana* ♂.
18. *Enispa flavipars* ♂.
19. *Eublemma eremochroa* ♂.
20. „ *ochricosta* ♀.
21. „ *arenostrota* ♂.
22. *Toana nigrilineata* ♂.
23. *Chionoxanthia leucophæa* ♂.
24. *Œdicodia strigipennis* ♂.
25. „ *melanographa* ♀.
26. *Ozarba semitorrida* ♂.
27. „ *endoscota* ♀.
28. „ *hemipyra* ♀.
29. „ *hemisarca* ♂.
30. „ *exolivacea* ♂.
31. „ *mesozonata* ♂.
32. „ *endoplaga* ♂.
33. *Eulocastra argyrostrota* ♂.
34. *Aulotarache plumbeogrisea* ♀.
35. *Constantiodes pyralina* ♂.
36. *Hoplotarache ectorrida* ♂.
37. „ *cæruleopicta* ♂.
38. *Tarache mesoleuca* ♂.
39. „ *miogona* ♀.
40. *Eutelia grisescens* ♂.
41. *Acanthonyx seriopuncta* ♂.
42. *Cerocala albimacula* ♂.
43. *Auchenisa cerurodes* ♂.
44. *Authadistis camptogramma* ♂.
45. *Catephia pyramidalis* ♂.
46. „ *pericyma* ♂.
47. „ *poliochroa* ♀.
48. „ *mesonephele* ♂.
49. „ *eurymelas* ♂.
50. *Lyncestis diascota* ♂.

PLATE II.

Fig.			Fig.		
1.	*Asplenia rubrescens*	♂.	26.	*Victoria sematoperas*	♂.
2.	*Tephrias trigonosema*	♀.	27.	*Selagena eustrigata*	♂.
3.	*Plecoptera polymorpha*	♂.	28.	*Metarbela diodonta*	♂.
4.	*Magulaba grisea*	♂.	29.	,, *perstriata*	♀.
5.	*Naarda nigripalpis*	♂.	30.	*Duomitus mesosticta*	♂.
6.	*Rhynchina endoleuca*	♂.	31.	,, *steniptera*	♂.
7.	,, *perangulata*	♀.	32.	,, *simillima*	♂.
8.	,, *albiscripta*	♂.	33.	*Featheria obvia*	♂.
9.	*Aclonophlebia inconspicua*	♂.	34.	*Scotinochroa minor*	♂.
10.	*Scrancia discomma*	♀.	35.	*Cœnobasis chloronoton*	♂.
11.	*Sesquialtera ridicula*	♀.	36.	*Gavara leucomera*	♀.
12.	*Cœnina tergimacula*	♂.	37.	*Rhodoneura hamatipex*	♂.
13.	*Tephrina prionogyna*	♀.	38.	*Calamoschœna ascriptalis*	♂.
14.	*Discalma calvifrons*	♂.	39.	*Macalla purpureopicta*	♀.
15.	,, *puerilis*	♂.	40.	*Dattinia perstrigata*	♂.
16.	*Ptychopoda aperta*	♂.	41.	,, *peratalis*	♂.
17.	,, *subtorrida*	♀.	42.	,, *costinotalis*	♂.
18.	*Acidalia pyrrhochra*	♀.	43.	*Bostra pyrochroalis*	♀.
19.	,, *timia*	♀.	44.	*Sameodes ocellata*	♀.
20.	,, *minoa*	♀.	45.	*Pionea rubritinctalis*	♀.
21.	*Tricentroscelis protrusifrons*	♀.	46.	,, *melanostictalis*	♂.
22.	*Eucrostes astigmatica*	♀.	47.	*Pyrausta sthenialis*	♂.
23.	*Hierochthonia featheri*	♀.	48.	,, *conistrotalis*	♀.
24.	*Neromia manderensis*	♀.	49.	*Cornifrons albidiscalis*	♂.
25.	*Prasinocyma perpulverata*	♂.	50.	*Noctuelia globuliferalis*	♂.

Horace Knight del. et lith.

West, Newman chr.

SOMALILAND LEPIDOPTERA.

From the Annals and Magazine of Natural History, Ser. 8, Vol. xii., *July* 1913.

Descriptions of new Species of African Heterocera in the Oxford Museum. By G. T. Bethune-Baker, F.L.S., F.Z.S.

Notodontidæ.

Stauropus dambæ, sp. n.

♀. Head and thorax chocolate-brown, with a large admixture of greenish rough scales. Primaries creamy grey, thickly irrorated with green and dark red-brown scales; the postmedian deeply crenulate line, more or less obscured, is dark red-brown; submarginal line dark red-brown, deeply waved, prominent, and continued along the fold across the middle of the cell and less distinctly along the costa; this somewhat unusual marking should serve to easily discriminate the species. Secondaries pale brown, with the usual *Stauropus* apical mark.

Expanse 47 mm.

Hab. Damba Island, on the Equator in the Victoria Nyanza, 20 miles south-east of Entebbe.

Type in the Oxford Museum.

Dr. Carpenter found the larva on April 12th; it spun up on the 14th of that month, and the imago emerged on May 2nd following.

Peratodonta bella, sp. n.

♂. Head and face tawny brown; collar prominent, ochreous, broadly tipped with tawny brown; thorax purplish grey, with patagia pinkish; abdomen with dorsum pinkish grey; ventral surface purplish grey. Primaries with dark linear costa, below which they are tawny brown, gradually becoming paler and shading off into pale pinkish, and in parts of the cell to cream-colour; an oblique more or less wedge-shaped patch of dark tawny brown occupies the terminal area, beginning in a fine line in the apex and getting rapidly wider to vein 2; below vein 2 the whole of the inner margin is pale tawny ash-colour; in the middle of the terminal area is an irregular, pale bright olive-brown, tooth-shaped mark extending shortly upwards towards the apex. Secondaries uniform cream-colour.

♀. Like the male, but without the sharp contrasts, the colours being duller, more uniform, the terminal area being pinkish rather than tawny, whilst the secondaries are darkish brownish grey; the last segment of the abdomen has a pale ash-grey tuft.

Expanse, ♂ 38, ♀ 49 mm.

Hab. Oni, 70 miles E. of Lagos.

Types in the Oxford Museum.

Male taken by W. A. Lamborn in the verandah of his house at Oni Camp, 4 P.M., Sept. 9, 1911; the female at 3 P.M. on Sept. 10. A second male was taken in the same position at 4 P.M. on Sept. 9. Mr. Lamborn is confident that all three specimens had emerged from the pupæ of captured larvæ that had escaped. Mr. Lamborn also captured a third male at rest on the upperside of a leaf in the forest, 1 mile east of Oni, March 23, 1911. All four specimens appeared in the wet season, which lasted from March 15 to Dec. 8, 1911.

Arctiadæ.

Acantharctia rubrifemora, sp. n.

Head, face, thorax, abdomen, and both wings pure white; legs white, with bright red femora above. Primaries with all the veins edged with pale greyish brown. Secondaries spotless.

Expanse 45 mm.

Hab. Damba Island, Uganda.

Type in the Oxford Museum. Bred by Dr. Carpenter, June 25, 1911, from a larva which spun June 9.

Lymantridæ.

Lœlia rogersi, sp. n.

♀. Head, thorax, and abdomen creamy grey. Primaries pale ochreous grey, with three parallel, oblique, wavy darker lines; basal area paler grey. Secondaries subhyaline whitish, without any marks.

Expanse 35 mm.

Hab. Fort Hall (Kikuyu), B.E. Africa.

Type in the Oxford Museum. Taken by the Rev. K. St. A. Rogers on March 20, 1907.

Lœlia acuta, sp. n.

♀. Head and thorax pale rufous brown; abdomen dirty cream-grey. Primaries pale rufous brown, somewhat paler on the fold and in the postmedian area, the only mark being an obscure dark greyish oblique stripe from the costa close to the apex to near the middle of the cell. Secondaries pale straw-colour.

Expanse 36 mm.

Hab. Damba Island, Uganda.

Type in the Oxford Museum. Bred Sept. 24, 1911, from a larva found by Dr. Carpenter.

Cifuna nigroplagata, sp. n.

♀. Head, thorax, abdomen, and both wings dull cinnamon-brown. Primaries with a large blackish patch at the end of the cell extending to the costa; from the angle of vein 3 an obscure trace of an oblique darker stripe to the middle of the inner margin; a trace of a submarginal irregular line, with some dark points in the upper radial portion; fringes darkly intersected. Secondaries with an obscure dark dash closing the cell; a submarginal indefinite irregular band of darker shading; fringes unicolorous.

Expanse 36 mm.

Hab. Damba Island, Uganda.

Type in the Oxford Museum. Bred July 12, 1911, from a larva found by Dr. Carpenter. The cocoon was spun July 1.

Dasychira geoffreyi, sp. n.

♂ ♀. Head and thorax grey, very finely irrorated with brownish; abdomen ochreous grey. Primaries pale ochreous grey, with fine brown irrorations sparsely spread in the cell

and fold, very thick on the costa and beyond the cell in the costal area, but less thick on the terminal area; a trace of a basal irregular line; a darkly outlined spot closing the cell, with a crenulate postmedian fine dark line; termen and fringes darkly spotted. Secondaries ochreous grey, becoming greyer towards the termen.

Expanse, ♂ 38, ♀ 50 mm.

Hab. Damba Island, Uganda.

Types in the Oxford Museum. Bred from larvæ found by Dr. Carpenter. First cocoon was spun May 4, 1911; the first emergence occurred May 17–18.

There is one specimen much more prominently and darkly marked, so that it is possible there may be a fair range of variation with this species, as is the case with some others of the genus.

Dasychira umbrensis, sp. n.

♂ ♀. Head, thorax, abdomen, and both wings dull darkish brown, of a mottled appearance, with very little definite marking. Primaries with three dark dots at the lower angle of the cell arranged in an inverted triangle; an obscure, dark, irregular, strongly serrate postmedian line; a series of submarginal interneural dark spots; fringes spotted in both wings. Secondaries uniform in colour.

Expanse, ♂ 43, ♀ 48 mm.

Hab. Damba Island, Uganda.

Types in the Oxford Museum. Bred from larvæ found by Dr. Carpenter. First cocoon was spun July 15, 1911, and the first moth emerged July 26.

Dasychira carpenteri, sp. n.

♂. Primaries very pale grey, with a dark basal line, highly dentate; a double irregular median line, enclosing a whitish space in which is a dark dot; the outer line is highly scalloped; beyond this is another interrupted serrate line; cell closed by a dark crescent, with a small spot in the crescent, above which and slightly further out is a dark costal patch, followed by a double crenulate postmedian line; termen with an irregular series of dark spots; the wing is dusted a good deal with very fine brownish scales. Secondaries straw-yellow, with a broad darkish border tapering down to the anal angle.

♀. Similar to the male, but darker grey, with the lines less prominent and with the crescent-shaped mark closing the cell developed into a fair-sized spot.

Expanse, ♂ 40, ♀ 50 mm.

Hab. Damba Island, Uganda.

Types in the Oxford Museum.

The male and female were captured *in copulâ* by Dr. G. D. H. Carpenter in the first half of June, 1911, on the shore on the E. side of Damba Island. Dr. Carpenter has also bred a series of seven specimens from larvæ taken on Damba Island. Cocoons were first spun June 3, 1911, and the first moth emerged June 13. Three specimens, apparently of this species, exist unnamed in the British Museum. The locality given is Ilesha, N. Nigeria.

Agaristidæ.

Schausia flavifrons, sp. n.

♂. Both wings black, with white patches. Primaries with a white basal point; a small white subovate patch in the cell; a large, long, oblong postmedian patch; a leaden basal stripe; a very oblique leaden stripe across the hinder third of the cell; cell closed with a leaden crescent; an oblique leaden subapical stripe and a trace of one below the costa. Secondaries with a large subhyaline white central patch to well beyond the cell. Palpi, frons, collar, and pectus bright orange.

Expanse 48 mm.

Hab. Mombasa.

Type in the Oxford Museum. Collected by the Rev. K. St. A. Rogers on March 13, 1906.

Lasiocampidæ.

Gastroplakœis idakum, sp. n.

♀. Head, face, and terminal segments of abdomen pale orange-grey; thorax and abdomen pale ochreous grey, the latter being the paler. Primaries pale ochreous grey, irrorated finely with darker grey; costa finely ashen grey, with an enlarged ashen area in front of the apex; a trace of a fine grey, crenulate, median line; the fine, very oblique, crenulate postmedian line is grey, and is followed by an irregular very oblique line of grey shading; a blackish spot closes the cell. Secondaries uniform pale straw-colour.

Expanse 60 mm.

Hab. Idakun, 4 miles N.W. of Oni Camp (Lagos district).

Type in the Oxford Museum. The larvæ were found by W. A. Lamborn on the 2nd of February, 1912; they spun

their cocoons on the 7th, and emerged on the 23rd of March in that year.

Mr. Lamborn's note, dated 24th March, 1912, is as follows :—"The larvæ were pale green in colour, with a median longitudinal black band on the dorsal aspect, and they were covered with short hairs. The thoracic legs were brilliant scarlet. When one touched a larva it suddenly threw back the anterior portion of its body, bringing the ventral surface uppermost, so that the legs were prominently displayed. They were then quivered violently."

Three larvæ, all of the same age, were found on one small plant, growing at the side of a forest-path.

Zygænidæ.

Saliunca egeria, sp. n.

♂. Head, antennæ, thorax, and abdomen black ; patagia chestnut-brown. Primaries chestnut-brown, rather darker on the fold and towards the termen ; a long, dusky, wedge-shaped mark between veins 5 and 8, rapidly tapering through the cell. Secondaries uniform sooty brown.

Expanse 30 mm.

Hab. Bugalla, Sesse Islands, in the N.W. of the Victoria Nyanza.

Type in the Oxford Museum.

This specimen, the only one seen by Dr. Carpenter, was captured at rest on a grass-stem, Jan. 21, 1912, in an open grassy area on the island. Dr. Carpenter notes that at rest the wings are disposed flat over the back, with costal margins [? inner margins] loosely apposed. In this attitude the moth closely resembles some of the Lycid beetles which are common on the island.

VII. *Note sur* Lucanides *conservés dans les collections de l'Université d'Oxford et du British Museum.* Par M. H. Boileau, F.E.S.

[Read October 16th, 1912.]

Plate IX.

Parmi les auteurs qui se sont spécialement occupés de l'étude des Lucanides, il faut citer au premier rang le Professeur Westwood et le Major Parry auxquels on doit un très grand nombre de descriptions et de remarques utiles.

Beaucoup d'autres descriptions plus anciennes sont indiquées dans les publications sous le nom du Révérend Hope, mais il est juste de dire que certaines d'entre elles paraissent en réalité devoir être attribuées à Westwood. Il semble que l'on puisse, en particulier, considérer comme telles les descriptions des *n. sp.* insérées dans le Catalogue publié en 1845 sous le titre: "A Catalogue of the Lucanoid Coleoptera in the Collection of the Rev. F. W. Hope." Cette brochure porte en effet un sous-titre: "With descriptions of the new species therein contained," au dessous duquel, sur certains exemplaires,* se trouve la mention manuscrite, de la main de Westwood, "by J. O. Westwood." Il est extrêmement probable que ces descriptions, qui ne sont guère que de courtes diagnoses, sont bien dûes à Westwood et que la mention "Hope" qui suit le nom des *n. sp.* décrites est une simple indication de catalogue, n'ayant pas plus de valeur que la mention "Catalogue Dejean" donnée pour certaines espèces également citées dans cet opuscule.

Quoi qu'il en soit, l'ensemble des descriptions de Hope, Westwood et Parry constitue encore maintenant une des bases importantes de l'étude des Lucanides, aussi ai-je été particulièrement heureux en 1906, de profiter d'un court voyage en Angleterre pour examiner le plus grand nombre possible des types décrits par ces auteurs. Ceux auxquels

* Un de ces exemplaires, ayant été envoyé à Snellen von Vollenhoven par Westwood a été mentionné par Albers (Deutsch. Ent. Zeitschr., 1884, p. 301) qui a signalé le fait et ses conséquences. Je possède également un de ces catalogues à titre modifié par Westwood et je présume qu'il en existe d'autres.

le nom de Hope a été attaché sont, pour la plupart, conservés au musée de l'Université d'Oxford. M. le Professeur Poulton, que je ne saurais assez remercier de son excellent accueil, a poussé l'obligeance jusqu'à me confier quelques-uns de ces précieux spécimens que j'ai ainsi pu étudier avec tout le soin désirable. Dans ce même musée et dans les riches collections du British Museum, où j'ai trouvé, grâce à MM. Waterhouse et G. Arrow, les plus grandes facilités d'étude, se trouvent également de nombreux types de Westwood et de Parry, ainsi que plusieurs espèces remarquables, décrites par M. Waterhouse.

Beaucoup de ces espèces sont, en fait, restées tout à fait inconnues de la plupart des spécialistes, les anciennes diagnoses étant absolument insuffisantes pour les caractériser, aussi ai-je pensé qu'il ne serait pas inutile de résumer les résultats de l'étude que j'en ai pu faire, quelque incomplète qu'elle soit en raison du peu de temps dont j'ai disposé à Londres et à Oxford. J'ai joint à ces notes, quelques-uns des croquis faits sur place, bien qu'ils ne soient pas ce que j'aurais désiré donner ici. Une revision analogue, mais d'une tout autre importance, a été faite par le Major Parry au moment de l'établissement de son premier Catalogue.* Il est évident que pour ce travail considérable et de haute valeur, Parry a dû examiner les types conservés à Oxford, vraisemblablement avec l'aide de Westwood. A ce moment, les matériaux d'étude dont on disposait, lui permirent déjà de très nombreuses rectifications. Mais, pour plusieurs espèces, des doutes ont subsisté, et j'aurai plus loin l'occasion de montrer que dans certains cas la synonymie adoptée d'après Parry est erronée et doit être rectifiée. Nous avons en effet maintenant, non pour toutes, mais pour la plupart des espèces anciennes, des éléments de comparaison bien plus considérables que ceux auxquels avaient recours les anciens descripteurs et il nous est ainsi devenue possible de reconnaître leurs erreurs. Celles-ci sont d'ailleurs bien excusables quand il s'agit d'insectes tellement variables dans leur forme et leur taille qu'à plusieurs reprises les spécialistes les plus autorisés ont réuni des espèces très distinctes, ou séparé sous deux, trois et même quatre noms les différents développements de la même espèce.

Les observations dont je donne ici le résumé, portent sur tous les types qu'il m'a été possible de reconnaître en

* A Catalogue of Lucanoid Coleoptera, etc. etc., Trans. Ent. Soc. Lond., 1864.

examinant les collections. La plupart de ceux-ci ont d'ailleurs été identifiés depuis longtemps par les entomologistes éminents qui ont eu la charge des collections et se trouvent très correctement étiquetés. Ces précieux spécimens sont, en général, tant à Londres qu'à Oxford, dans un état de conservation des plus satisfaisants. Leurs anciennes étiquettes ont, le plus souvent, été scrupuleusement conservées, précaution qui a une importance considérable et qui permet, dans bien des cas, de reconnaître si tel ou tel spécimen se rapporte ou non aux descriptions anciennes et constitue un type ou tout au moins un cotype de l'espèce. J'ai également mentionné certains exemplaires qui, sans être des types, appartiennent à des espèces rares ou intéressantes.

Pour plus de simplicité j'ai suivi, dans ces notes, l'ordre approximatif de la classification adoptée par Parry, qui n'a d'ailleurs pas été modifiée sensiblement par les récents auteurs. Je me borne à mentionner les types revus en 1906, sur lesquels aucune observation ne me paraît utile à présenter, en indiquant par les lettres B. M. (British Museum) et U. O. (Université d'Oxford) les collections dans lesquels ils sont conservés.

Sphenognathus higginsi Parry, Ent. Monthl. Mag., 1876, p. 174. Le mâle de cette espèce est jusqu'à présent fort rare. Outre le type, qui fait partie de la collection de M. R. Oberthür, et un exemplaire de la collection Van de Poll, actuellement dans ma collection, je ne connais que le spécimen du British Museum. Ces trois insectes sont absolument différents du *S. garleppi* que j'ai décrit, et la synonymie qui figure fréquemment sur les catalogues des marchands allemands et dont je ne connais pas l'auteur, est erronée. *S. higginsi* est un insecte de plus petite taille que *S. garleppi*, ses mandibules sont plus rectilignes; les angles antérieurs et surtout les angles postérieurs du prothorax sont arrondis, la saillie humérale des élytres est coupée obliquement. Tous ces caractères n'existent pas chez *S. garleppi*.

Sphenognathus canaliculatus Parry, Trans. Ent. Soc. Lond., 1874, p. 368, pl. 4, fig. 2.—Le type, conservé au British Museum, ressemble beaucoup à un petit mâle de *S. feisthameli* Guérin; les angles antérieurs de la tête sont très aigus; la couleur est celle du *S. feisthameli ;* la double épine des angles postérieurs du prothorax est peu développée. Pour affirmer la synonymie il serait nécessaire de comparer

le type à plusieurs exemplaires de même développement du *S. feisthameli*, mais elle me paraît au moins vraisemblable.

Dendroblax earlei White, Voyage Ereb. and Terror, 1846, Ent., p. 9, pl. 2, figs. 9–10. Le type conservé au British Museum paraît être un mâle d'après ses antennes.

Rhyssonotus jugularis Westwood, Trans. Ent. Soc. Lond., 1863, p. 429, pl. 14, fig. 1. Le type, présumé être une femelle, mais qui me paraît plutôt être un mâle, est conservé au British Museum.

Lamprima schreibersi Hope in litt. L'insecte type est un mâle de taille moyenne de *L. aurata* Latr., de couleur verte, avec la tête vert doré un peu rougeâtre.

Lamprima coerulea Donovan, Ins. Nov. Holl., 1805, tab. 1. Il existe, au musée d'Oxford et au British Museum, quelques exemplaires d'une *Lamprima* d'un vert plus ou moins bleu, parfois bleu violacé, ayant la tête d'un vert bronzé, à peine un peu rougeâtre sur les carènes céphaliques, qui présentent, outre leur couleur spéciale, une légère modification de la forme habituelle des mandibules, surtout pour celle de gauche. L'extrémité des mandibules se trouve en effet plus ou moins nettement quadridentée au lieu d'être, comme d'ordinaire, tridentée, ce qui est réalisé par l'existence d'une petite dent supplémentaire placée entre la dent supérieure simple et la dent apicale bifurquée. Ces insectes paraissent être des *L. latreillei* M. L., faiblement modifiés et peuvent être considérés comme appartenant à une variété ou sous-variété de cette espèce. Je n'en ai vu des spécimens que dans des collections anciennes où ils sont en général étiquetés : "*Coerulea* Donovan." Leur provenance exacte m'est inconnue. Il y a huit spécimens à Oxford dont un beau mâle, très typique, venant de la collection Hope et deux autres grands exemplaires bien caractérisés, provenant de la collection Westwood. Trois autres sont au British Museum. (Pl. IX, fig. 5, *L. coerulea*, mandibules.)

Lamprima fulgida Dupont (type ou cotype ?). Sous le nom de *puncticollis* Hope, *fulgida*, Dupont, sont conservées à Oxford plusieurs femelles, dont l'une porte une étiquette visiblement très ancienne, sur laquelle se trouvent tracés, d'une écriture allongée, les mots : "*fulgida* mihi." C'est une *L. aurata* Latr.

Lamprima puncticollis Dejean, Hope in litt. Le spécimen qui porte la mention : "*puncticollis* Dej." est également une *L. aurata* Latr. (U. O.).

Lamprima insularis Hope in litt. Le spécimen de Hope est un mâle de *L. micardi* Reiche, assez grand exemplaire de couleur bronzée, à pointe sternale assez forte. (U. O.)

Lamprima purpurascens Hope, type, Cat., p. 28. L'insecte ainsi désigné est également un mâle de *L. micardi* Reiche, assez grand, de couleur bronzée rosâtre (U. O.). Espèce omise par Parry dans son Catalogue.

Lamprima tasmaniae Hope, type, Cat., p. 27. Le type paraît être un petit exemplaire, vert foncé, à courtes mandibules, de *L. latreillei* MacLeay. Cette synonymie a été indiquée par Parry (Cat. 1864, p. 69). (U. O.)

Lamprima subrugosa Hope, type, Cat., p. 28. Le type est un mâle moyen de *L. aenea* Fabr., comme l'a indiqué Parry (Cat. 1864, p. 70). (U. O.)

Lamprima sumptuosa Hope, type, Cat., p. 28. Le type est un petit spécimen, assez étroit, parallèle, de couleur dorée cuivreuse, de *L. micardi* Reiche. Parry a considéré dans son premier Catalogue (Cat. 1864, p. 7 et p. 70) cette espèce comme distincte, mais elle ne se sépare de *L. micardi* par aucun caractère valable (U. O.).

Lamprima nigricollis Hope, type, Cat., p. 28. Cette espèce n'a pas été mentionnée par Parry dans son Catalogue de 1864. Le type conservé à Oxford est une femelle d'un noir glacé bleu, avec la tête vert doré nuancée de rouge cuivre. Les pattes sont presque noires. La saillie du prosternum est presque nulle. L'insecte porte une étiquette : "*Nigricollis* Hope, *micardi* teste Parry," qui prouve que cette *Lamprima*, quoique non inscrite au Catalogue de 1864, a été examinée par Parry. Je rapporte également ce spécimen à *L. micardi* Reiche.

Streptocerus speciosus Fairmaire, Ann. Soc. Ent. Fr., 1850, p. 53. La femelle, figurée par Westwood (Tr. Ent. Soc., ser. 2, vol. iii., 1853–56, p. 204, pl. xi., figs. 1, 1*a*, 1*b*, 1*c*, 1*d*), est conservée à Oxford.

Colophon thunbergi Westwood, Trans. Ent. Soc. Lond., 1855, p. 198, pl. 10, fig. 2 type. L'exemplaire, conservé à Oxford, correspond bien à la figure donnée par Westwood, mais les étiquettes sont récentes. Le type du *C. westwoodi* Gray, figure également dans la collection. L'examen de ces spécimens est d'autant plus intéressant que M. Péringuey a cru devoir mettre en doute la validité de l'espèce et a affirmé, un peu légèrement, que le *C. thunbergi* était simplement la femelle du *C. westwoodi*. Je ne sais sur quels documents est basée la conviction de M. Péringuey, mais il

me paraît certain qu'elle n'est pas exacte. Le *C. thunberbi* du Musée d'Oxford est un spécimen dont les parties génitales et la mâchoire de gauche ont été disséquées. Ces mêmes organes se retrouvent sur un carton où se trouve la mention: "Genitalia et max. *Colophon buffonii*, Wd." Ce dernier nom était probablement celui que Westwood s'était d'abord proposé de donner à l'espèce. Les organes génitaux sont ceux d'un mâle. *C. thunbergi* doit donc être considéré comme distinct de *C. westwoodi.*

Il est à noter d'ailleurs que Westwood a formellement affirmé que le type du *C. thunbergi* était un mâle et non comme on pourrait le supposer, l'autre sexe du *C. westwoodi.*

Colophon westwoodi Gray, in Griff. Anim. Kingd., 1832, p. 534., pl. 46, fig. 5, type. L'insecte porte deux étiquettes anciennes: "*Colophon lethroides* Hope, *westwoodi* G." avec l'indication ajoutée au crayon "♂" et "*Colophon westwoodi*, Gray in Griff., Westw. in Ann. Sc. Nat." Sur un carton se trouvent l'organe génital, qui est celui d'un mâle, et le dernier segment abdominal, côté dorsal. Ce carton porte: "Genitalia *Colophonis westwoodi.*" Le spécimen, conservé au British Museum, est également un mâle. D'après ce qui précède, les hypothèses de M. Péringuey doivent être rejetées.

Phalacrognathus westwoodi Shipp., Trans. Ent. Soc. Lond., 1893, p. 223. Le type est un mâle de *Ph. muelleri* M. L., appartenant à la forme majeure, mais non au maximum de son développement.

Pseudolucanus atratus Hope, in Gray, Zool. Miscell., 1831, p. 22, Cat., p. 10. Le type est un mâle de faible développement, à mandibules simples, provenant du Nepaul (U. O.).

Lucanus lusitanicus Hope, type, Cat., p. 9. C'est un mâle de très grande taille, de la forme un peu spéciale, allongée et élégante, qui se trouve dans la péninsule et se rencontre déjà dans les Pyrénées. Cette race ressemble à celle de Syrie, mais les antennes ne diffèrent pas de celles du *L. cervus* ordinaire.

Lucanus lunifer Hope, in Royle Ill. Nat. Hist. Hymal. Ins., 1833, p. 55, pl. 9, fig. 4, Cat. p. 9. Le mâle type est de grande taille, la fourche des mandibules est pointue et ne présente pas l'élargissement apical que l'on remarque sur certains exemplaires. La femelle type, *L. rugifrons* Hope, est petite, elle se rapporte bien à cette espèce (U. O.).

Lucanus cantori Hope, Proc. Ent. Soc. Lond., 1842, p. 83,

types. Le mâle est un exemplaire moyen, la femelle type existe également dans la collection (U. O.).

Lucanus villosus Hope, in Gray, Zool. Miscell., 1831, p. 22. Un mâle de cette rare espèce existe au British Museum, il n'est pas impossible que ce soit le type de Hope. D'après le Catalogue Hope, p. 4, le *L. villosus* n'existait pas dans la collection Hope. Je ne l'ai pas retrouvé à Oxford. L'espèce était représentée dans la collection Parry par un couple, actuellement conservé dans la collection de M. R. Oberthür, mais ce couple, d'après le Catalogue dressé au moment de la vente de la collection Parry, ne comprenait pas de type.

L'insecte du British Museum, très voisin du *L. lunifer* par les mandibules, se rapproche également beaucoup de cette espèce par la tête, le thorax et les pattes.

Lucanus mearesi Hope, Proc. Ent. Soc. Lond., 1842, p. 83, Cat., p. 10. Le type est un grand mâle dont la fourche mandibulaire ne présente pas d'élargissement sur la dent apicale (U. O.).

Lucanus nigripes Hope, Cat., p. 10. Parry a signalé (Cat., 1864, p. 72) que cet insecte était la femelle du précédent, ce qui avait déjà été indiqué comme possible dans la diagnose originale. Le spécimen étiqueté comme type est une femelle de taille médiocre, sans étiquette ancienne. Cet insecte doit bien être rapporté au *L. mearesi*. Une autre femelle, de plus grande taille, qui porte l'étiquette ancienne : " Mearse, India," appartient également à cette espèce. L'attribution du type à l'une ou à l'autre des deux femelles peut être douteuse, mais la synonymie demeure, de toute façon, correcte (U. O.).

Lucanus westermanni Hope, Cat., p. 10. Le type est un mâle moyen, ne présentant aucune particularité (U. O.).

Lucanus vicinus Hope, Cat., p. 10. Cette espèce est une de celles qui ont donné lieu à des discussions. Elle a été admise par Parry (Cat. 1864, p. 73), et ce spécialiste possédait un spécimen passé ensuite dans la collection Barton et actuellement conservé dans ma propre collection, qu'il considérait comme un *L. vicinus*. Cet exemplaire porte, de la main de Parry, une étiquette ainsi libellée : " *L. vicinus*, Hope, from his coll. Ind. O. Burm., says good sp. from Poonah but ? a sp. very close to *cervus*." L'insecte présente tous les caractères d'un *L. cervus* de forme mineure, légèrement déformé par un accident, aussi la synonymie : *L. vicinus* Hope = *L. smithi* Parry, donnée par M. Planet

dans sa monographie* (vol. ii, p. 63) d'après l'examen du type du *L. vicinus* par M. R. Oberthür, m'avait toujours semblée fort douteuse. La diagnose du Catalogue Hope dit en effet expressément que le type ressemble à un *L. cervus* de petite taille et appartient peut-être à une simple variété géographique. L'examen fait par M. R. Oberthür a dû être des plus superficiels, ou aura porté sur un autre exemplaire que le type, car, après avoir étudié ce spécimen, je ne puis lui trouver aucune parenté avec *L. smithi.* Il ressemble au contraire beaucoup à l'exemplaire de Parry que j'avais emporté à Oxford, mais est plus grand et sans défectuosité. Il n'y a pour moi aucun doute sur l'attribution de ces insectes, qui sont des *L. cervus* de forme mineure. Quant à leur provenance, l'hypothèse la plus vraisemblable est que ces deux seuls spécimens connus du *L. vicinus* sont des *L. cervus* européens, emportés ou envoyés aux Indes et qui auront été réexpédiés sans indication de provenance, soit volontairement, soit par erreur. Des confusions de ce genre se sont produites plusieurs fois et se produisent encore assez fréquemment; j'ai reçu, pour ma part, un *Dorcus parallelipipedus* de Sumatra et des *Figulus* de l'Amérique du Sud, sans parler des erreurs nombreuses de provenance que l'on trouve dans toutes les anciennes collections.

Lucanus americanus Hope, Cat., p. 10. Cet insecte a été considéré par Parry comme synonyme du *L. cervus.* Le type est d'un aspect très singulier. C'est évidemment un insecte immature. Les élytres sont presque complètement décolorées et les tarses sont jaunes. La forme ellemême est assez spéciale. L'insecte paraît être un *L. cervus* mineur, mais très fort pour son développement mandibulaire, et beaucoup plus massif que cela n'est habituel pour ceux de ces insectes qui proviennent de l'Europe occidentale. J'ai reçu récemment un lucane de cette forme, mais plus petit, provenant de Sarepta (Russie Méridionale) et, dans l'état actuel de nos connaissances, on peut admettre que c'est à une race locale analogue qu'appartient le *L. americanus* Hope.

Je dois cependant dire que, d'après des spécimens femelles qui se trouvent dans plusieurs collections, il

* "Généralement désigné dans les collections sous le nom de *Smithii* que lui a donné Parry, ce Lucane n'est autre que la *Luc. vicinus*, ainsi que M. R. Oberthür a pu le constater l'année dernière à Oxford, en examinant la collection de Hope." Planet, *loc. cit.*

semblerait exister, dans l'Amérique du Nord, un *Lucanus* plus grand que le *L. elaphus.* Mais ces femelles, dont il existe deux exemplaires au British Museum, sont très distinctes de celles du *L. cervus* et il paraît bien peu vraisemblable que leurs mâles se rapportent au *L. americanus* Hope.

Lucanus laminifer Waterhouse, Ann. Mag. Nat. Hist., 1890, p. 33. Les types existent au British Museum; ils comprenaient un mâle d'une espèce distincte, que j'ai séparé et décrit sous le nom de *L. dohertyi.*

Lucanus swinhoei Parry, Trans. Ent. Soc. Lond., 1874, p. 370, pl. 4, fig. 4. Les types, mâle et femelle, sont au British Museum.

Lucanus sp. ? Planet, Essai Monographique, vol. ii, p. 124, fig. 75. M. Planet a figuré (*loc. cit.*) d'après un croquis de l'album de Parry conservé chez M. R. Oberthür, un singulier mâle de *Lucanus* provenant du Liban, et l'a rapproché, avec quelque doute, du *Lucanus* qu'il a décrit, dans le même travail, sous le nom de *L. cervus*, var. *akbesiana* Planet, Essai Monogr. vol. i, p. 62. Pl. 14, fig. 2. J'ai retrouvé cet exemplaire dans la collection du British Museum. Il porte les étiquettes anciennes: "*Macrophyllus ?* Reiche, Syria, Lebanon, *n. sp.* Dr. Meryon."

L'insecte est un spécimen défectueux. Les deux mandibules ont été arrachées et mal rentrées dans leurs alvéoles, ce qui leur donne l'aspect falciforme reproduit par le croquis de Parry. En examinant l'insecte, on voit extérieurement, à la base de la mandibule, l'apophyse sortie de son logement. La tête et le corps sont ceux d'un *L. ibericus* Motsch. (*orientalis* Kraatz) assez fort et assez plat. [Pl. IX, fig. 14].

Rhaetus westwoodi Parry, Proc. Ent. Soc. Lond., 1862, p. 108, type mâle, conservé au British Museum.

Hexarthrius longipennis Hope, Cat., pp. 10, 11. Cet insecte est indiqué, dans la diagnose, comme provenant de Java et de l'Assam et comme pouvant être la femelle de l'*Hexarthrius rhinoceros* Ol. Parry, (Cat. 1864, p. 74) a admis cette hypothèse et, dans la collection d'Oxford, le type a été réuni aux spécimens de *H. rhinoceros.* Les étiquettes que porte cet insecte sont: 1° "Java." 2° "*longipennis* Hope." 3° "*longipennis* Hope Assam." La provenance Assam doit être considérée comme erronée. L'insecte, étroit avec des élytres longues, une tête très bombée et des canthus oculaires arrondis extérieurement, me paraît être

une femelle de l'*Hexarthrius buqueti* Hope. *Hexarthrius rhinoceros* Ol. est rarement reçu de Java et, de plus, la structure de *H. rhinoceros* femelle est plus courte et plus robuste que celle du type de *H. longipennis.*

Hexarthrius falciger Hope, Cat., p. 11. Cet insecte a également été réuni à *H. rhinoceros* Ol. par Parry (Cat., 1864, p. 74) comme appartenant à la forme mineure de cette espèce. Le type provient de Java et porte les mêmes étiquettes de provenance que le spécimen type de *H. longipennis*, toutefois au lieu d'" Assam " la troisième étiquette indique " Java." L'insecte est de très faible développement et difficile à déterminer à vue, il me paraît cependant être un *H. buqueti* Hope (U. O.).

Hexarthrius forsteri Hope, Trans. Linn. Soc. Lond., 1841, p. 587, pl. 40, fig. 1, Cat., p. 11. Cette espèce est représentée par trois spécimens anciens. Des deux plus grands, qui portent l'étiquette " *Calanus*, Hope," le second pour la taille correspond très bien avec la figure donnée par le descripteur (Linn. Trans. 18, 588, tab. 40, fig. 1). Le plus petit porte l'étiquette " *Cantori* Hope." (U. O.) *Hexarthrius serricollis* Hope, Cat., p. 11, est bien, comme l'a indiqué Parry (Cat. 1864, p. 74), la femelle de *H. forsteri* (U. O.).

Hexarthrius davisoni Waterhouse, Ann. Mag. Nat. Hist., 1888, p. 250. Cette espèce, dont les types sont conservés au British Museum, a bien pour synonymes *H. cotesi* Nonfried et *H. castetsi* Boileau.

Cladognathus confucius Hope, Proc. Ent. Soc. Lond., 1842, p. 60, Cat., p. 18. J'espérais trouver dans les collections de l'Université d'Oxford le type de Hope, mais je l'ai cherché inutilement. Par contre, les exemplaires indiqués par la diagnose comme se rapportant à cette espèce et autrefois nommés *L. whithillii* Hope existent dans la collection; mais ce sont sans aucun doute des *C. giraffa* Fabr. ainsi que l'a indiqué Parry.

Les deux plus grands exemplaires mesurent l'un 34 lignes, l'autre 31. Le premier porte les indications : " Withill, Bombay " et " *Confucius* var. *Withillii* Hope," le second : " *Withillii* Hope " et " Khasyah Hills." Deux autres mesurent 26½ et 25 lignes, et ont simplement les étiquettes de provenance : " Poona " pour le premier, " Bombay " pour le deuxième. Ils représentent probablement le *C. brahminus* Hope.

Le *C. confucius* type est indiqué comme ayant eu 28

lignes; il ne correspond donc à aucun de ces spécimens; on voit d'ailleurs qu'il s'agit d'un petit exemplaire. Le provenance "Chusan" me porte à croire que le type doit bien être un *C. confucius* tel que nous le comprenons maintenant; la confusion faite par Hope (ou Westwood) entre les deux espèces voisines s'explique par le faible développement du type du *C. confucius.*

C. downesi Hope, Cat. p. 19, type, existe dans la collection d'Oxford; c'est une femelle courte et large, dont l'étiquette de provenance est Bombay; on doit la considérer comme étant une femelle de *C. giraffa* Fabr.

Psalidoremus motschulskyi Waterhouse, Trans. Ent. Soc. Lond., 1869, p. 16. Le type de cette espèce est conservé au British Museum. Dans la description, la provenance est indiquée "Japon ou Archipel Indien." Je possède, de cette espèce, deux exemplaires qui se trouvaient dans la collection Barton et venaient de la collection Parry, comme aussi le type de la description. Tous deux sont de la forme mineure mais se rapportent bien au *P. motschulskyi* et ont été déterminés comme tels par Parry. Le plus grand porte l'indication : "I. Formose," l'autre : "Coll. Saunders Formosa." La provenance Formose me paraît donc certaine; elle est d'ailleurs tout à fait vraisemblable [Pl. IX, fig. 13].

Metopodontus downesi Hope, Trans. Zool. Soc. Lond., 1835, p. 99, pl. 13, fig. 7, Cat., p. 11. Très exactement représenté par la figure donnée par le descripteur (Zool. Trans. i, p. 99, pl. 13, fig. 7), le type est conservé à Oxford.

Metopodontus savagei Hope, Ann. Mag. Nat. Hist., 1842, p. 494, Cat., pp. 11, 12. Deux mâles et une femelle sont indiqués comme étant les types. La femelle seule porte une indication un peu précise de localité : "Palmas."

Metopodontus ungulatus Hope, Ann. Mag. Nat. Hist., 1842, p. 494, Cat., p. 12. Le type, conservé comme les précédents à Oxford, est, comme l'a indiqué Parry (Cat. 1864, p. 82) un *M. savagei* de forme mineure. Ses mandibules sont inermes.

Metopodontus castaneus, Hope, Cat., p. 12. Cette espèce a toujours été considérée comme valable. L'insecte indiqué comme type dans la collection d'Oxford mesure exactement les 24 lignes indiquées par la description. Il porte deux étiquettes anciennes : "*Castanea*," "*Castaneus* Sn. P. Walker." Les mandibules sont celles d'un exemplaire

appartenant à la forme moyenne des *Metopodontus* de cette section (*Metopodontus* vrais); elles présentent une dent basale trituberculée, aucune dent médiane, et trois denticules anté-apicaux. Par la forme générale, la coloration, surtout celle des pattes et des élytres, et par l'angle médian du prothorax cet insecte se rattache, sans aucun doute possible, au *M. cinnamomeus* Guérin, de Java. Le *M. castaneus*, Hope, doit donc passer en synonymie. Comme je l'indique plus loin les espèces que l'on reçoit habituellement de l'Inde et que l'on désigne dans les collections sous le nom de *M. castaneus* sont, en réalité, des *M. foveatus* Hope, ou des *M. poultoni* Boileau.

Metopodontus omissus Hope, Trans. Linn. Soc., 1842, p. 591, Cat., p. 12. Ainsi que l'a indiqué Parry (Cat. 1864, p. 79) le type est un *M. foveatus* Hope. L'exemplaire étiqueté comme type appartient à la forme moyenne. Les mandibules, dépourvues de dent médiane, ont une double dent basale. Il existe un autre exemplaire, qui semble ancien; un peu moins développé, contrairement à l'indication donnée par Parry (*loc. cit.*) et conformément à la diagnose.

Metopodontus foveatus Hope, Trans. Linn. Soc., 1842, p. 590, Cat., p. 12. Comme je viens de l'indiquer, c'est le *M. castaneus* Hope de la plupart des collections. Le nom de *M. foveatus* est seul valable, la description du *M. omissus* suivant celle du *M. foveatus* et étant relative à un plus petit exemplaire de la même espèce. Le type est un mâle intermédiaire entre la forme moyenne et la forme majeure. Les mandibules ont une dent médiane simple, à gauche, mais celle-ci est seulement aux deux cinquièmes de la longueur à partir de la base. A droite, la dent est bifide. L'insecte vient de Sylhet. L'indication " Java " qui suit la provenance correcte " Assam " dans le Catalogue, vient évidemment d'une confusion avec d'autres exemplaires appartenant au *M. cinnamomeus* Guérin, qui auront sans doute été vus par Hope ou Westwood dans d'autres collections.

Metopodontus astacoides Hope, Trans. Linn. Soc. 1842, p. 590, Cat., p. 12. Parry a déjà indiqué que cet insecte était un *M. foveatus* minor (Cat. 1864, p. 79). Le type est un exemplaire à mandibules entièrement denticulées.

Metopodontus fraternus Hope, Cat., pp. 12 13. La même synonymie correcte a été donnée par Parry (*loc. cit*). Le type ne diffère du précédent que par ses mandibules

incomplètement denticulées; il appartient à un développement plus fort.

Metopodontus (Hoplitocranum) macclellandi Hope, Proc. Ent. Soc. Lond., 1842, p. 83, Cat., p. 13. Le type est un petit exemplaire à mandibules entièrement denticulées. Les pattes postérieures ne portent pas les pinceaux soyeux de l'espèce voisine, généralement connue sous le nom de *M. calcaratus* Jakowleff et que je considère comme étant en réalité le *M. jenkinsi* Westwood.

Metopodontus fulvipes Hope, Cat., p. 13. La synonymie donnée par Parry (Cat., 1864, p. 79) : *fulvipes* = *cinnamomeus* var. min. est exacte. Le type est un mâle de très petite dimension du *M. cinnamomeus.* Il porte l'étiquette : "*fulvipes*" au verso de laquelle se trouve l'indication "*rafflesii* Hope," qui a été barrée. Le *M. rafflesii* Hope (Proc. Ent. Soc. Lond., 1844, p. 106), est, suivant Parry, (Cat. 1864, p. 79) la femelle du *M. cinnamomeus ;* je n'ai pas retrouvé ce type à Oxford, par contre celui du *M. pallidipennis* Hope (Trans. Linn. Soc., 1842, p. 590) s'y trouve conservé; c'est un grand mâle du *M. cinnamomeus*, dont la seule particularité à signaler est l'existence d'une dent médiane double à la mandibule de droite. Il résulte de ce qui précède que le *M. cinnamomeus* Guérin a été décrit quatre fois par Hope et Westwood sous les noms de *pallidipennis*, *castaneus*, *fulvipes* et *rafflesii.*

Metopodontus impressus Waterhouse, Trans. Ent. Soc. Lond., 1864, p. 17, types conservés au British Museum. Cette espèce est intéressante, peu connue; sa provenance exacte est ignorée. Elle se rapproche des espèces pour lesquelles Jakowleff avait créé le sous-genre *Hoplitocranum ;* les femelles, en particulier, sont fortement ponctuées et rappellent celles de ce groupe, dont elles ont à peu près la taille. Je ne considère pas comme absolument certain que le plus grand mâle appartienne à la même espèce que les autres.

Metopodontus limbatus Waterhouse, Ann. Mag. Nat. Hist., ser. 5, xix, p. 381, types mâle et femelle, British Museum. Cette espèce est tantôt considérée comme distincte, tantôt comme synonyme de *M. cinctus* Montrouzier. En général les exemplaires que l'on rapporte au *M. limbatus* forment passage entre le *M. cinctus* et le *M. torresensis ;* ils sont assez allongés, un peu cylindriques, avec une large bordure jaune aux élytres et semblent former une sous-variété ou une race locale. Dans le

collection du British Museum, il y a bien, sous la désignation *cinctus*, quelques spécimens de cette forme, provenant des Iles Murray, Cornwallis et du Cap York. Mais les véritables types viennent des Iles Thursday et ne me paraissent pas différer des *M. cinctus* de Nouvelle Guinée et des îles voisines. Le *M. cinctus* lui-même peut difficilement être séparé du *M. bison*, qui varie suivant les provenances et dont il constitue une variété.

Metopodontus roepstorffi Waterhouse, Ann. Mag. Nat. Hist., ser. 6, v, p. 35, dont les types sont également au British Museum, ne peut guère être considéré que comme une variété du *M. occipitalis* Hope, dont la répartition géographique est fort étendue et qui varie sensiblement suivant les provenances. Les marques noires de la femelle, plus fortes que d'habitude, n'ont pas grande importance; on retrouve d'ailleurs sur des femelles du *M. occipitalis* de diverses localités la forte macule élytrale portée par les femelles du *M. roepstorffi*.

Metopodontus occipitalis Hope, Cat., p. 13. Le type mâle est un spécimen de forme moyenne, à mandibules symétriques; la femelle, brillante, présente une suture élytrale et des macules thoraciques très nettes; les macules céphaliques sont peu développées. Ces insectes n'ont conservé aucune étiquette d'origine, mais la diagnose indique qu'ils proviennent des Philippines, ce qui concorde bien avec leur structure.

Metopodontus inquinatus Westwood, Cab. Or. Ent., p. 18, pl. 8., fig. 4. Je pense que le couple conservé au British Museum est formé par les deux types. Cet insecte est resté très rare dans les collections; il est étroitement apparenté au *M. biplagiatus* Westwood. Comme dans cette espèce, mais d'une manière moins nette, le mâle du *M. inquinatus* porte trois carènes sur la face inférieure des joues.

Prosopocoelus cavifrons Hope, Cat., p. 13. Le type est un spécimen de forme majeure (U. O.).

Prosopocoelus lateralis Hope, Cat., p. 13. Il existe deux types mâles, le premier est un exemplaire de forme majeure, dont les mandibules sont dépourvues de dent médiane, le second appartient à la forme mineure. La femelle type est également conservée à Oxford. Quelques spécimens de la collection portent le nom *exaratus* Dejean.

Prosopocoelus quadridens Hope, Cat., p. 14. Cette espèce, et les quatre suivantes, sont restées très douteuses

et l'examen que j'en ai fait ne m'a pas permis de déterminer aussi exactement que je l'aurais désiré, leur synonymie véritable. La question se complique du fait que l'attribution réelle du *P. antilopus*, Swederus, est également restée problématique. Enfin il semble que les *Prosopocoelus* africains de ce groupe soient à la fois très proches et assez variables, ce qui rend encore plus difficile leur délimitation et leur synonymie.

Le *P. quadridens* type [Pl. IX, Fig. 8. mandibule] est un insecte d'un roux obscur, plus foncé sur la tête et le thorax. Les mandibules, la tête, le pronotum, sont finement et régulièrement granuleux; les élytres sont dépolies, avec la région suturale noircie et assez brillante; il existe de faibles traces de côtes. L'exemplaire est un mâle de forme majeure, dont les mandibules, légèrement élargies à la base, inermes sur la plus grande partie de leur longueur, portent chacune deux dents antéapicales, dont la plus voisine de l'apex est la plus forte. Ce sont donc les deux mandibules considérées ensemble qui portent quatre dents. Cet insecte est étiqueté comme venant de Sierra Leone. Un autre, presque pareil, est indiqué de "Cape Palmas." Ces deux exemplaires sont conservés au Musée d'Oxford. Je possède des spécimens tout à fait analogues venant de Sierra Leone, d'Assinie, du Dahomey, et même du Congo; je considère également que le *Prosopocoelus* que l'on reçoit du Cameroun, et qui est de couleur un peu plus claire, ne diffère pas de cette espèce, c'est, je pense, cette variété qui a été décrite par M. Kolbe sous le nom de *P. camarunus* (Ent. Nachr., 1897, p. 12).

Tous ces insectes, et spécialement certains spécimens du Cameroun, semblent devoir être rapportés au *P. antilopus* Swederus, quoique la description et le dessin ne permettent pas une affirmation absolue sur ce point. De toute façon, il est certain que le *P. quadridens* est identique au suivant :

Prosopocoelus sayersi Hope, Cat., p. 14. Le type [Pl. IX, fig. 9, mandibule], qui est également un mâle de grand développement, a une dent de plus aux mandibules et l'extrémité fourchue de celles-ci est un peu plus plate. La dent supplémentaire, qui est assez faible, est voisine du milieu, et se trouve implantée dans le plan de la face inférieure de la mandibule qui est, comme chez *quadridens*, de section plutôt carrée qu'arrondie. Or si l'on regarde bien les mandibules du *quadridens*, on voit qu'il existe une faible carène formant un rudiment de denticule au dessous

de la première dent et un peu plus près de celle-ci que chez le *P. sayersi*. Sauf des différences insignifiantes, les deux spécimens sont identiques comme forme et couleur et le nom de *sayersi* doit, de toute façon, ainsi que l'avait déjà indiqué Parry (Cat. 1864, p. 83) être considéré comme un simple synonyme de *quadridens*.

Prosopocoelus speculifer Hope, Cat., p. 14. Le mâle et la femelle, qui sont les types de Hope, sont des spécimens de petite taille. La couleur est sombre, avec la région suturale rembrunie et noirâtre. Les joues sont creuses, la saillie de l'épistome est simple. Cette espèce, qui est certainement identique à la suivante, *P. piceipennis* Hope, décrite antérieurement, me paraît pouvoir être également assimilée au *P. camarunus* Kolbe qui n'en diffère guère que par une coloration plus claire. Les types du *P. speculifer* sont de Cape Palmas.

Prosopocoelus piceipennis Hope, Cat., p. 14. Le type est un insecte de forme élégante et de couleur sombre, appartenant à un développement moyen. Les mandibules sont relativement assez grêles. Les bords du pronotum ne sont pas droits, mais légèrement concaves avant l'angle médian. La tête et le prothorax sont granuleux. La provenance, d'après l'étiquette ancienne, est Sierra Leone. Parry a admis que les *P. piceipennis* et *speculifer* représentaient respectivement la forme moyenne et la forme mineure du *P. quadridens*. S'il en est bien ainsi, comme je suis aussi disposé à le croire, le nom de *piceipennis* aurait la priorité sur les autres, mais ne serait valable que si la description du *P. antilopus* Swed. devait être rapportée à une autre espèce, ce qui semble vraiment peu probable.

En résumé, dans l'état actuel de nos connaissances, on peut considérer les *P. piceipennis*, *quadridens*, *sayersi* et *speculifer* Hope, ainsi que le *P. camarunus* Kolbe, comme synonymes du *P. antilopus* Swederus.

Prosopocoelus martini Hope, Cat., p. 14. Parry a admis (Cat., 1864, p. 82) que cet insecte représentait une forme du *P. senegalensis* Klug. L'insecte conservé à Oxford diffère certainement du *P. piceipennis*; il est encore plus foncé comme couleur, la suture élytrale est largement teintée de noir. Les canthus oculaires sont droits; les côtés du prothorax sont concaves derrière l'angle médian. Les tibias postérieurs sont inermes, comme l'indique la diagnose, mais portent un renflement indiquant que des exemplaires plus petits et les femelles ont une épine à

cette paire de pattes comme à la précédente. L'épistome forme une saillie simple, peu prononcée. Tous ces caractères se retrouvent chez le *P. senegalensis* et la synonymie donnée par Parry me semble exacte.

Prosopocoelus hanningtoni Waterhouse, Ann. Mag. Nat. Hist., 1890, p. 34. Cette espèce, dont les types sont au British Museum, se rattache au groupe du *P. serricornis* Latr.; elle ne diffère que par des caractères sans importance de l'espèce, largement répandue dans l'Afrique orientale allemande, qui a été ensuite décrite par M. Nonfried sous le nom de *P. brunneus* (Ent. Nachr., 1892), et que ce dernier considérait comme une variété du *P. serricornis* Latr. de Madagascar.

Prosopocoelus oweni Hope, Cat., pp. 14, 15. Le type est un petit mâle. Les mandibules présentent chacune un tubercule inférieur, plus développé à droite, mais bien distinct aussi à gauche. Il se rapporte bien aux spécimens ordinairement déterminés comme *P. oweni* dans les collections.

Prosopocoelus subangulatus, Hope, Cat., p. 24. Cet insecte est conservé à Oxford, comme le précédent. Ainsi que l'a indiqué Parry (Cat. 1864, p. 82), c'est la femelle du *P. oweni*.

Prosopocoelus bulbosus Hope, Trans. Linn. Soc., xviii, p. 589, tab. xi, fig. 2, nec. *P. bulbosus* Hope, Cat., p. 20. Parry a signalé (A Revised Catalogue of the Lucanoid Col. etc. Trans. Ent. Soc. Lond., 1870, p. 84) que le *P. bulbosus* Hope, Cat., p., 20, était un autre insecte que le *P. bulbosus* Hope antérieurement décrit dans les Trans. Linn. Soc. Le vrai *P. bulbosus*, tel qu'il a été figuré (*loc. cit.*) a la saillie de l'épistome simple et le *P. bulbosus* du Catalogue a cette saillie bituberculée. Je reviendrai, en parlant du *P. spencei* Hope, sur les conclusions que Parry a cru devoir tirer de cette constatation.

Le *P. bulbosus* type, conservé à Oxford, est certainement celui qui a été décrit dans les Trans. Linn. Soc., 1841, p. 589. Il est bien conforme au dessin donné dans cette publication (tab. xi, fig. 2). La saillie de l'épistome est simple.

Par contre, je n'ai pas vu les spécimens ayant servi de base à la description du Catalogue, mais il est très possible qu'ils existent dans la collection d'Oxford, mon attention ne s'étant pas portée sur l'intérêt que présentait, en réalité, leur recherche.

Prosopocoelus punctiger Hope, Cat., p. 24. C'est une femelle, qui appartient certainement à ce groupe. Il serait nécessaire de l'examiner avec beaucoup de soin pour pourvoir la rapporter à l'une ou l'autre des espèces connues et la synonymie (= *spencei* ♀) donnée par Parry (Trans. Ent. Soc. Lond., 1870, p. 85), est basée sur l'hypothèse incorrecte de l'identité du *P. bulbosus* Hope (Trans. Linn. Soc.) et du *P. spencei.*

Prosopocoelus spencei Hope, Cat., p. 19. Cette espèce qui a été décrite par Hope (Trans. Linn. Soc., xviii, p. 589) d'après un mâle unique de développement maximum, de la collection Cantor, est en réalité peu connue et a donné lieu à des discussions anciennes, ainsi qu'à des confusions nombreuses. L'étude du type, conservé à Oxford, est donc particulièrement intéressante.

Dans son premier Catalogue (1864, p. 37) Parry a exposé les motifs pour lesquels il croyait devoir considérer *P. spencei* comme étant la forme maxima, très rare, du *P. bulbosus ;* malgré l'aspect très différent des mandibules, il avait aisément reconnu la parenté des deux insectes.

Ultérieurement, dans son deuxième Catalogue (1870, p. 84), comme je l'ai dit plus haut. Parry a signalé qu'il y avait, en réalité, deux *P. bulbosus* distincts, l'un décrit par Hope dans les Trans. Linn. Soc. en 1841 en même temps que le *P. spencei*, l'autre décrit dans le Catalogue des Lucanides de la collection Hope en 1845. Les deux espèces diffèrent par la saillie de l'épistome, qui est simple chez le premier et bituberculée chez le second; de plus on peut remarquer que la taille indiquée pour les deux spécimens types n'est pas exactement la même : unc. 1, lin. 6 pour le premier, lin. 17 pour le second. Dans son travail, Parry a admis à nouveau l'identité spécifique du *P. bulbosus* décrit en 1841 et du *P. spencei ;* il a considéré, de plus, que la *P. crenicollis* Thomson, Ann. Soc. Ent. Trans., 1862, p. 418, était également assimilable au *P. spencei ;* enfin il a laissé le nom de *P. bulbosus* à l'espèce décrite dans le Catalogue Hope de 1845.

Plus tard encore, Parry semble avoir eu quelques doutes sur l'identification du *P. crenicollis* Thomson, puisque dans son troisième Catalogue, publié en 1875, le *P. crenicollis* est rétabli au nombre des espèces distinctes et signalé, en même temps comme manquant à sa collection; cette espèce n'est d'ailleurs pas indiquée dans le Catalogue de la vente de la collection en 1885. Il me paraît probable que, dans

l'intervalle écoulé entre la publication de son deuxième et de son troisième Catalogue, Parry aura eu l'occasion de voir en nature le *P. crenicollis* et qu'il aura reconnu qu'il différait notablement du *P. bulbosus* Hope (Trans. Linn. Soc.) qu'il considérait toujours comme étant la forme mineure du *P. spencei*.

Le fait que Parry n'a pas eu à sa disposition un spécimen du *P. crenicollis* et n'a pu, par suite, le comparer au type resté unique du *P. spencei* explique bien qu'il ait persisté à identifier le *P. bulbosus* à cette dernière espèce. La grande forme des deux *P. bulbosus* n'a d'ailleurs été reçue qu'une dizaine d'années plus tard. Si, à ce moment, la synonymie véritable n'a pu être établie, malgré le bon dessin du *P. spencei* donné par Parry (Cat., 1870, pl. 2. fig. 1), cela tient à ce que ce dessin laisse un petit doute sur la position et la grandeur de la dent médiane. On peut en effet supposer qu'il existe une dent supérieure dressée, dont les contours auraient été faiblement indiqués, analogue à celle des exemplaires de la forme maxima des *P. bulbosus*. La description est d'ailleurs encore moins explicite que le dessin sur ce point particulier.

En réalité, il n'y a aucune dent supérieure [Pl. IX, fig. 6 *a*, *b*, *c*, mandibule ; *d* menton], et la petite dent que l'on voit sur le dessin de Parry et qu'on pourrait prendre pour la projection de l'extrémité de la dent supérieure, est un denticule placé sur la carène interne inférieure. Cette disposition est absolument différente de ce qui existe chez *P. bulbosus* et suffit à séparer immédiatement les mâles de développement majeur. Un autre caractère réside dans la forme de la carène suturale du menton, qui est simple chez *P. spencei* et trilobée chez les deux *P. bulbosus* ; ce caractère est d'autant plus marqué que le développement est plus grand, les mâles de la forme mineure proprement dite ont la carène suturale simple pour les trois espèces. Enfin les canthus oculaires du *P. spencei* sont plus élargis en arrière que ceux des deux *P. bulbosus*, les crénelures thoraciques sont plus marquées et la forme est plus élégante.

Il faut conclure de ces différences que *P. spencei* n'est pas la forme majeure de *P. bulbosus* Hope (Trans. Linn. Soc.), qui constitue une espèce distincte.

Il en résulte immédiatement que *P. bulbosus* Hope, Cat., p. 20 qui constitue également une bonne espèce, doit recevoir un nouveau nom. Il me paraît bien juste de lui

donner celui de Parry, qui a reconnu le premier la différence des deux *P. bulbosus* décrits par Hope.

Quant au *P. crenicollis* Thomson, je n'ai pas de notes sur les types de cette espèce, qui doivent faire partie de la collection de M. R. Oberthür, mais si je m'en rapporte à l'examen d'un spécimen qui faisait partie de la collection Mniszech et que j'ai trouvé dans la collection van de Poll avec l'étiquette " *Crenicollis*, comparé " il serait identique à l'insecte que j'ai décrit en 1904 (Le Naturaliste, 15, xii, p. 285) sous le nom de *P. mordax.* La description de Thomson, assez médiocre, s'applique à peu près à cet insecte. J'ai peu de doutes que le *P. laticeps* Möllenkamp dont la description a paru à la même date (Ins. Börse, 15, xii, p. 402) soit une espèce distincte de celle-ci, mais sa description est trop sommaire pour que je puisse l'affirmer absolument.

En étudiant le type du *P. mordax*, et le spécimen du *P. crenicollis* mentionné ci-dessus, ainsi qu'un exemplaire de la même espèce qui se trouve conservé au British Museum et porte l'indication " *spencei* Hope, *crenicollis* Thomson," il m'a paru probable que ces trois insectes appartiennent à des formes mineures plus ou moins développées du *P. spencei.* Le passage de la forme mineure de grande taille à la forme maxima, étant très brusque dans ce groupe, il est difficile d'arriver à une certitude complète tant qu'on n'a pas vu une série suffisante de spécimens de taille variée, mais la synonymie me paraît d'autant plus vraisemblable qu'on ne connaît aucun autre insecte pouvant représenter la forme mineure du *P. spencei.*

Si mes conclusions sont correctes, on peut donner le tableau suivant des quatre espèces affines qui constituent ce petit groupe :

A. Saillie de l'épistome simple.

a. Suture du menton formant une carène lobée chez les exemplaires de grand et moyen développement.

b. Une dent supérieure médiane chez les mâles de développement maximum.—1.

1. *P. bulbosus* Hope Trans. Linn. Soc., 1841, p. 589, pl. 40, fig. 2.

c. Suture du menton formant une carène simple chez les exemplaires de grand et moyen développement.

d. Pas de dent supérieure médiane chez les mâles de développement maximum.—2.

2. *P. spencei* Hope Trans. Linn. Soc., 1841, p. 589.—
   Synonymes : *P. crenicollis* Thomson, Ann. Soc. Ent. Fr., 1862, p. 418.
   P. mordax, Boileau, Le Naturaliste, 1904, p. 285.
   ? *P. laticeps,* Möllenkamp, Ins. Börse, 1904, p. 402.

   B. Saillie de l'épistome bituberculée.
      a. Une dent supérieure médiane chez les mâles de développement maximum.
      b. Suture du menton formant une carène lobée chez les exemplaires de grand et moyen développement.—3.

3. *P. parryi* n.n. (= *P. bulbosus*) Hope, Cat., p. 20.
      c. Suture du menton formant une carène simple chez les exemplaires de grand et moyen développement.—4.

4. *P. dentifer* H. Deyrolle, Ann. Soc. Ent. Belg., 1865, p. 29, tab. 1, fig. 5.

Pour cette dernière espèce, très rare jusqu'à présent, j'ajouterai que la taille est plus petite et que les côtés du prothorax sont très faiblement crénelés.

Prosopocoelus tenuipes Hope, Cat., p. 18. Le type du musée d'Oxford est une femelle brillante, appartenant évitemment a un *Prosopocoelus* de la section du *P. buddha* Hope. D'après es étiquettes anciennes, elle aurait été envoyée des Philippines, par Cuming. La synonymie donnée par Parry (Cat., 1864, p. 81) = *cavifrons* ♀, paraît exacte.

Prosopocoelus curvipes Hope, Cat., p. 25. Le type d'Oxford est une femelle de très petite taille, noire et très brillante, ayant un aspect bien distinct de celui des autres femelles du groupe. Outre l'étiquette d'origine " Poona " cet insecte porte l'indication suivante : "*Figuloides* Parry, ♀, allied to *bulbosus.*" Parry a décrit (Cat. 1864, p. 35) le mâle de cette curieuse petite espèce dont les rares exemplaires ne se trouvent que dans les anciennes collections. Quoique très distincte, c'est en effet du groupe du *P. bulbosus,* plus spécialement du *P. spencei* qu'on peut la rapprocher. Le grand développement est inconnu. Il existe au British Museum deux mâles, dont l'un porte une note de Parry " not in Hope's coll." Ce n'est pas le type, qui doit se trouver actuellement dans la collection de M. R. Oberthür. L'autre mâle est intéressant comme appartenant à une forme minima de l'espèce.

Aulacostethus archeri Waterhouse, Trans. Ent. Soc. Lond., 1869, p. 14 pl. iii, figs. 1, 1 *a*, 1 *b*.—L'insecte paradoxal,

difficile à classer, très exactement décrit par M. Waterhouse, est, à ma connaissance, resté unique jusqu'à présent. Il présente un curieux mélange de caractères dont plusieurs peuvent faire supposer une adaptation à une vie partiellement souterraine: réduction des yeux, position de ces organes, gracilité et brièveté des tarses, élargissement considérable des extrémités des tibias médians et postérieurs qui semblent disposés pour pousser en arrière [B.M.] [Pl. IX, fig. 12 *a*, antenne; 12 *b*, extrémité du tibia postérieur.]

Homoderus johnstoni Waterhouse (in Johnston, Uganda Protectorate, 1902, i, p. 460). Un spécimen femelle, conservé au British Museum, sans doute le type de l'espèce. Elle porte l'indication de localité " Entebbe. Oct. 1900." et une étiquette " Sir H. H. Johnston, 1901, 281." C'est une femelle de forte taille qui a la couleur d'un rouge obscur de l' *H. gladiator* Jakowleff. Elle ressemble extrêmement à la femelle du *preussi* Kolbe. Sa validité spécifique me semble très douteuse.

Prismognathus platycephalus Hope, Proc. Ent. Soc. Lond., 1842, p. 83. Le type, conservé à Oxford, grand exemplaire mâle.

Cantharolethrus buckleyi Parry, Trans. Ent. Soc. Lond., 1872, p. 77, tab. 1, fig. 1 ♂, fig. 2 ♀. Le musée d'Oxford possède deux mâles et une femelle de cette rare espèce. Le grand mâle et la femelle sont les types de Parry.

Cyclommatus strigiceps Westwood, Cab. Or. Ent., p. 18, tab. 8, fig. 5. Le type, conservé à Oxford, bien conforme au dessin donné par Westwood: c'est un mâle de grand développement, ne présentant aucune macule sur le disque du pronotum.

Cyclommatus multidentatus Westwood, Cab. Or. Ent., p. 18, tab. 8, fig. 3. Cette espèce a été considérée par Parry (Cat., 1864, p. 84) comme étant synonyme de la précédente (*strigiceps* var. min.). L'exemplaire décrit par Westwood doit être celui qui se trouve dans la série du British Museum avec l'étiquette ancienne " E. India " " Type *Cyclophtalmus multidentatus* locat. in Or. Entomology." Ce mâle, qui appartient à la forme mineure, se distingue immédiatement des autres *C. strigiceps* de développement analogue par sa taille notablement plus forte, sa couleur plus rougeâtre, les côtés du prothorax plus parallèles avec l'angle médian moins épineux, les élytres plus striées. Je ne puis le considérer comme appartenant à la même espèce; il en est

voisin, mais distinct. Il serait utile de le comparer à des *C. mniszechi* de même développement.

Cyclommatus affinis Parry, Trans. Ent. Soc. Lond., 1864, p. 40. Le type de Parry est conservé au British Museum; c'est un spécimen de forme moyenne, dont le dent basale est quadridentée; l'épistome est un pentagone dont les quatre côtés libres sont légèrement concaves. Avec ce mâle s'en trouve un autre, de plus grand développement, qui paraît aussi provenir de la collection Parry. Chez celui-ci la dent basale est simple et le triangle curviligne antérieur de l'épistome forme des pointes aiguës aux angles; le lobe interne de la région latérale antérieure de la tête, contre la mandibule, est très relevé.

M. Ritsema a admis la synonymie *C. affinis* Parry = *C. de haani* Westwood. Je n'ai pas assez d'éléments pour discuter actuellement cette question, je dois dire toutefois que les *C. de haani* de Sumatra, déterminés par M. Ritsema, que je possède, me paraissent différer sensiblement du type du *C. affinis* conservé au British Museum. La question de provenance des deux espèces devrait être tout d'abord bien éclaircie. D'après Westwood, le *C. de haani* était de Java. Il se trouve ainsi indiqué dans le Catalogue Hope, p. 5, et dans les trois Catalogues de Parry. Dans le Cabinet Oriental, il est donné comme provenant de Bornéo, mais on peut se demander si ce n'est pas à la suite de son identification présumée (et d'ailleurs inexacte) avec le *C. rangifer* Schönherr (= *tarandus* Thunberg). Le *C. macrognathus* White MSS. cité par Westwood comme étant un grand exemplaire du *C. de haani* paraît bien être un *C. tarandus*, et c'est à lui certainement que s'applique le renseignement de la capture faite par M. Hugh Lowe à Bornéo.

Outre cet exemplaire qui aurait fait partie des collections du British Museum, et que je n'ai pas remarqué, Westwood indique que l'espèce existait dans la collection Hope et dans la collection Melly. Je ne puis rien dire de celle-ci, où paraît être le type véritable. L'exemplaire de la collection Hope, conservé à Oxford, porte l'étiquette suivante: "*de haani* ♂ var. minor." "Sumatra." "Mus. Melly for type." Ce spécimen est un mâle de faible taille (28 mm.) dont les mandibules présentent un groupe basal et un groupe terminal de plusieurs denticules, les deux groupes étant séparés par un large intervalle inerme. Son aspect est celui d'un *C. canaliculatus* Ritsema, var. minor. Avec

lui sont trois spécimens, qui semblent intermédiaires entre le *C. canaliculatus* typique et le *C. frey-gessneri* Ritsema. Les exemplaires de *C. de haani* du British Museum sont des *C. frey-gessneri*, *canaliculatus* et *consanguineus*, les seuls exemplaires qui se rapprochent du *C. de haani*, tel que nous le comprenons, sont les spécimens de *C. affinis* venant de la collection Parry, cités plus haut.

Cyclommatus faunicolor Hope, Proc. Ent. Soc. Lond., 1844, p. 106. L'exemplaire conservé au musée d'Oxford, avec l'étiquette ancienne *C. faunicolor*, semble pareil à celui figuré par Westwood (Trans. Ent. Soc., 1847, pl. 20, fig. 1) mais ne porte aucune indication de type.

Leptinopterus polyodontus Hope, Cat., p. 15. Les deux spécimens d'Oxford sont très vraisemblablement les types de Hope. Le mâle porte la provenance " Bz." (Brazil) la femelle l'étiquette "*polyodontus*." Ce sont deux *L. ibex* Billberg, un grand mâle nettement caractérisé, une belle femelle.

Parry, dans son travail de 1864, n'a pas signalé cette synonymie et a laissé subsister le *L. polyodontus* Hope comme espèce distincte. Il est à remarquer, cependant, qu'il a donné, comme synonyme du *L. ibex* le *L. polyodontus* Dejean, d'après Reiche, Ann. Soc. Ent. Fr., ser. 3, i, p. 78.—Or dans le Catalogue Hope, l'indication " Dej. inédit " est donnée en tête de la description de l'espèce. Le *Leptinopterus polyodontus* Hope n'existe donc pas comme espèce. C'est Burmeister qui a réellement décrit le *L. polyodontus* tel que nous le comprenons (Handbuch, vol. v, p. 381).

Leptinopterus rufifemoratus Hope, Cat., p. 5, est bien la femelle de *L. femoratus* Fab., comme l'ont indiqué Hope lui-même (*loc. cit.*) et Parry. (Cat. 1864, p. 85). U. O.

Leptinopterus melanarius Hope, Cat., p. 15. Le type est un mâle de grand développement, qui correspond bien à la description du Catalogue. La mandibule porte une double dent basale peu développée, une forte dent intermédiaire, et se termine par trois denticules [pl. IX, fig. 4, mandibules]. Il porte simplement l'indication de provenance " Bz." et l'étiquette "*melanarius* Hope Bz." Le British Museum possède plusieurs spécimens tout à fait pareils dont deux indiqués de " São Paulo." Il n'y a pas de doute d'après la description de Burmeister (Handbuch, v, p. 379) que son *L. morio* ne soit identique au *L. melanarius*.

Leptinopterus funereus Hope, Cat., p. 15. Les types sont

un mâle moyen et une femelle. Il y a, de plus, un mâle minimum. Le plus grand des deux mâles a des mandibules assez développées, dépourvues de dent médiane, mais l'extrémité est formée par trois denticules comme chez le *L. melanarius*. Les tibias médians, chez ces deux types, portent une épine, précédée d'une autre très petite. La ponctuation est analogue. L'identité spécifique, admise par Parry (Cat., 1864, p. 85) me semble très probable. U. O.

Leptinopterus politus Hope MSS., localité " Bz." (Brazil) conservé à Oxford, est une femelle de *L. ibex* Billberg.

Leptinopterus ochropterus Hope MSS., spécimen portant les indications " Mex." et " *Ochropterus* mihi " est un mâle moyen de *L. tibialis* Eschscholtz. U. O.

Leptinopterus v-niger Hope, Cat., p. 15. Plusieurs mâles, et probablement une seule femelle ont servi à établir la diagnose. Le mâle portant l'étiquette type, à Oxford, est un spécimen de taille moyenne, de forme majeure, étiqueté " *v-niger* Hope." Il existe d'autres mâles étiquetés *Psalicerus cuspidatus*. La femelle ne porte aucune étiquette ancienne.

Leptinopterus fraternus Westwood, Trans. Ent. Soc. Lond., 1874, p. 359, tab. 3, fig. 3, ♂. Les types, mâle et femelle, sont conservés au British Museum.

Leptinopterus erythrocnemus Burmeister, Handbuch, v, p. 378. Le British Museum possède plusieurs spécimens de cet insecte. Chez un mâle et deux femelles, on constate le passage à la forme typique, qui est le *L. tibialis* Eschscholtz, dont le *L. erythrocnemus* ne doit être considéré, à mon avis, que comme une variété.

Macrocrates bucephalus Hope, Cat., p. 15. Le type, conservé à Oxford, est un beau spécimen mâle. Il existe également, dans la collection, sous les noms inédits de *Psalicerus rotundicollis* Gory, *nigripes* Dej. une femelle appartenant à la même espèce.

Odontolabis burmeisteri Hope, Trans. Ent. Soc. Lond., 1839, p. 279, tab. 13, fig. 3. Cat., p. 16. Le type est un mâle de forme majeure, bel exemplaire, mais plus grêle que ceux ordinairement conservés dans les anciennes collections. Il porte l'indication de provenance " Assam " qui est erronée et en désaccord avec la diagnose qui donne " Mysore." U. O.

Odontolabis cuvera Hope, Trans. Linn. Soc., 1843, p. 105, tab. 10, fig. 3. Le type est bien conforme au dessin mais

ne porte plus aucune étiquette ancienne. C'est un spécimen de forme majeure, de taille plutôt faible. U. O.

Odontolabis prinseppi Hope, Cat., p. 16. Comme l'a indiqué Parry (Cat., 1864, p. 75) le type est un mâle de forme moyenne (f. mesodont Leuthner). U. O.

Odontolabis saundersi Hope, Trans. Linn. Soc., 1843, p. 105. Cat. p. 16. Le Catalogue mentionne sous le nom de *O. delesserti* Guérin (= *O. saundersi* Hope, Cat. p. 5) un couple. La collection d'Oxford contient une femelle qui, comme l'a indiqué Parry (Cat., 1864, p. 75) est *O. cuvera*; ce spécimen provient de Khasyah-Hills. Deux mâles sont étiquetés comme *O. saundersi* Hope. Le plus grand porte une étiquette rouge, de Hope, " *Saundersii* Hope " et une autre blanche : " *bicolor.*" D'après l'étiquette du Musée ce serait le type d' *O. bicolor* Saunders, Trans. Ent. Soc. Lond., ii, p. 177, tab. 16, fig. 3. Toutefois, le deuxième mâle, plus petit, tout à fait de la forme priodont, porte une étiquette ancienne : " described by Saunders," probablement de Hope. Il y a un petit doute sur la question de savoir lequel est le type du *bicolor* Saunders et lequel du *delesserti* Hope, mais aucun sur le fait que ce sont tous deux des *O. cuvera.* Hope ne semble pas avoir possédé le véritable *O. delesserti* Guérin : tous les spécimens de sa collection sont des *O. cuvera* venant de " Khasyah-Hills."

Odontolabis sinensis Westwood, Cab. Or. Ent., p. 54, tab. 26, fig. 2, 3, ♂; fig. 4, ♀. Les types figurés par Westwood sont conservés à Oxford.

Odontolabis dux Westwood, Ann. Mag. Nat. Hist., 1846, p. 124. L'énorme exemplaire sur lequel a été fondée cette espèce (= *alces* Fabr. f. telodont) et qui a été figuré par Westwood (Cab. Or. Ent., p. 17, tab. 8, fig. 1) est conservé au British Museum.

Odontolabis cumingi Hope, Cat., p. 17. Le type, exemplaire de forme moyenne (amphiodont) d' *O. alces* porte de très nombreuses étiquettes anciennes. Il a été disséqué pour vérifier son sexe. Sa provenance est Manille. U. O. C'est au British Museum que se trouve conservée la curieuse série des têtes d'*O. alces,* figurée par Leuthner (Monographie, p. 399) à l'appui de sa distinction des quatre principales formes mandibulaires des lucanides de ce groupe. Cette division ne s'applique d'ailleurs qu'à un nombre restreint d'espèces; elle est en discordance avec ce qu'on remarque dans d'autres genres.

Odontolabis siva Hope, Cat., p. 16. Le mâle type est un

petit amphiodont. Il a été envoyé par le Dr. Cantor, d'après l'ancienne étiquette. La femelle type est également conservée à Oxford. Ainsi que l'a reconnu Leuthner (Monographie, p. 438) l'indication Java, donnée par Hope, Cat., p. 16, en contradiction avec celle donnée Cat., p. 5, est erronée. L'erreur commise provient sans doute de ce que cette espèce a été confondue avec *O. bellicosus*, Castelnau, qui en est assez voisine et vient de Java.

Odontolabis vishnu Hope, Cat., p. 17. Le type est un mâle amphiodont de *O. bellicosus* Castelnau, ainsi que l'a reconnu Parry. (Cat. 1864, p. 76.) L'étiquette ancienne indique la provenance " Java " et porte la mention " *Gazella* ♂ Hope " au dessus de laquelle est écrit : " *Vishnu.*" Cette indication concorde avec celle du Catalogue, p. 5. " *Vishnu* Hope, Java, an. *L. Gazella* mes. Fabr." qui est d'ailleurs erronée. U. O.

Odontolabis serrifer Hope, Cat., p. 17. Sous ce nom sont conservés deux petits exemplaires de forme mineure (priodont), qui paraissent être des *O. bellicosus*, comme l'a indiqué Parry (Cat., 1864, p. 76). U. O.

Odontolabis dalmani Hope, Cat., p. 17. Le type est un assez grand mâle qui ressemble, comme forme, aux exemplaires de cette espèce provenant de Sumatra. La diagnose indique comme provenance " Tenasserim," ce qui est possible. Aucune étiquette ancienne n'a été conservé pour cet insecte. U. O.

Odontolabis platynotus Hope, Cat., p. 18. Les spécimens considérés comme types par le musée d'Oxford sont deux femelles, dont l'une porte une étiquette ancienne " *glabratus* " et la provenance : " East India." Cette dernière, un peu plus courte que l'autre, paraît être le type véritable.

Odontolabis emarginatus Saunders, Trans. Ent. Soc. Lond., 1854, p. 49, pl. 3, figs. 4, 5. Trois exemplaires, deux mâles, une femelle, sont conservés sous ce nom à Oxford, mais sans indication de type. Il n'est pas impossible que le plus grand des deux mâles soit un des exemplaires de la collection Saunders. Son étiquette, analogue à celle des autres lucanides provenant de cette collection, porte les indications : " *Odontolabis emarginatus* (Reiche MS.) ♂ minor. W.W.S. Trans. Ent. Soc., n. s., vol. 3, pl. 3, fig. 5 ♂ minor nec ♀." Parry a donné (Cat., 1864, p. 77) la synonymie *O. platynotus* Hope. Leuthner (Monographie, p. 436) a émis l'hypothèse que la provenance indiquée par Hope était inexacte. En réalité, la distribution géographique de

O. platynotus paraît étendue, cette espèce, généralement reçue de Chine, se trouve aussi en Indo-Chine, au Tonkin, et Fea en a rapporté un exemplaire de Birmanie. J'ai vu plusieurs exemplaires indiqués de l'Inde, mais sans localité précise.

Odontolabis femoralis Waterhouse, Ann. Mag. Nat. Hist., 1887, p. 486.—Cette espèce, dont les types, provenant de Perak, ont été rapportés par M. Doherty et se trouvent au British Museum, n'est pas autre chose que l'énorme espèce retrouvée a Kina-Balu par M. Waterstradt, et décrite, sous le nom de *O. waterstradti*, par M. von Rothenburg, Deutsche Ent. Zeitschr., 1900, p. 84.

Les deux mâles de Perak ont le pronotum rougeâtre, l'un d'eux a même les angles latéraux marqués de jaune. Une femelle de Perak figure également dans la collection.

Cette espèce a dû être reçue antérieurement à 1887, car j'en ai trouvé, dans la collection Armitage, un mâle, visiblement ancien, indiqué " *Odontolabris* n. sp. Penang." Le pronotum de ce spécimen est légèrement rougeâtre.

Il est intéressant, au point de vue de la distribution géographique des espèces, de voir cette espèce de Malacca se retrouver dans la région nord de Bornéo.

Au sujet de cet *Odontolabis*, il est utile de faire remarquer que M. Möllenkamp a cru devoir considérer que *O. waterstradti* n'était pas la forme typique de l'espèce mais une variété, et a décrit, en conséquence, comme forme typique, son *O. kinabaluensis* (Ins. Börse, 1904, p. 341). Il convient de faire toutes réserves sur ces appréciations de ce qui est ou n'est pas la forme typique d'une espèce encore fort peu connue. On peut évidemment concevoir la forme typique comme représentant la moyenne des formes variables de l'espèce. Mais la détermination de cette moyenne est excessivement délicate et, actuellement au moins, la seule règle logique à suivre pour la nomenclature consiste à respecter les antériorités.

Partant de là, le nom véritable de l'espèce est *O. femoralis* Waterhouse; la forme typique est celle de Perak à pronotum légèrement rougeâtre et même marqué de jaune aux angles latéraux. *O. waterstradti* Rothenburg et *O. kinabaluensis* Möllenkamp ne représentent que deux variétés, la première est même très douteuse comme validité, et doit plutôt être considérée comme une sous-variété ou race locale.

Odontolabis latipennis Hope, Cat., p. 17. Le type, conservé à Oxford, est une femelle étiquetée " *Dejeanii* Reiche,

latipennis Hope verus" "Pr. Wales." (Prince of Wales Isl.)

Odontolabis cephalotes Leuthner, monographie, p. 478. Le spécimen, jusqu'à présent, je crois, seul connu de cette espèce, est conservé au British Museum.

C'est un grand mâle, entièrement différent de l' *O. striatus* Deyr. et qui appartient, sans aucun doute, à une espèce bien distincte.

L'hypothèse faite par M. van Roon dans son Catalogue des Lucanides (Tijdschr. v. Ent., i, 1907, pp. 58–70).—Tirage à part p. 63, reproduite d'ailleurs dans la Pars 8 du Coleopterorum Catalogus de Junk, du même auteur, p. 39 (*O. cephalotes* Leuthner, placé avec un peu de doute dans le genre *Eulepidius*) est d'ailleurs sans fondement. L'insecte n'a rien de commun avec *Eulepidius luridus* Westw., type du genre, qui est un proche parent des *Gnaphaloryx*, et il appartient bien aux *Odontolabis*. La différence la plus frappante entre *O. cephalotes* et *O. striatus* est dans la forme de la tête et des mandibules. Ces dernières, aplaties en largeur chez *O. striatus*, sont au contraire comprimées latéralement chez *O. cephalotes*. La dent basale est simple au lieu d'être double comme chez *striatus* et il existe une forte carène, surplombant le front, qui fait défaut, même chez les plus grands mâles connus de *striatus*.

Il convient de remarquer que cette forme, assez spéciale pour le genre, se retrouve, autant qu'on en peut juger par la figure publiée, chez *O. sarasinorum* Heller, espèce des Célèbes, également de petite taille, vraisemblablement apparentée à *O. cephalotes* Leuthner.

Odontolabis elegans Möllenkamp, Ins. Börse, 1902, p. 363.—Je crois utile de signaler ici qu'il existe au British Museum une femelle provenant de Malacca, ex collection Atkinson, sous le nom de *O. gazella*, qui ressemble tout à fait à la femelle de *O. elegans*. M. Zang a soutenu que *O. elegans* Möll. devait être considéré comme un simple synonyme de *O. mouhoti* Parry, hypothèse qui a été repoussée avec une véritable indignation par M. Möllenkamp, qui s'est basé sur les "800,000 kilomètres carrés" qui existent entre Carin Cheba (Birmanie), patrie de *O. elegans*, et le Cambodge, patrie de *O. mouhoti*, et sur ses "25 années d'études sur les Lucanides" pour déclarer que M. Zang manquait de toute preuve à l'appui de son affirmation.

Je dois dire que je ne puis partager cette manière de voir, et qu'ayant reçu, de M. Gestro, les chasses de M. Fea, en

Birmanie, d'où proviennent tous les exemplaires connus de *O. elegans*, je n'ai pas cru pouvoir décrire cette espèce, tant elle me paraissait proche de *O. mouhoti*. M. Möllenkamp déclare que *O. elegans* est " un petit lucanide gracieux," tandis que *O. mouhoti* a la tête large, et que les élytres de *O. elegans* ne sont pas aussi longues que celles de *O. mouhoti* sont larges. En réalité *O. mouhoti* est un peu plus grand que les spécimens connus de *O. elegans*, cependant le plus grand mâle (telodont) du Musée de Gênes mesure 66 mm. (mand. incl.); les élytres ont 26 mm. de long., la tête a 20·5 de large. *O. mouhoti* mesure 64 mm., avec des élytres de 28 mm. et une tête de 22·5. La couleur ne semble pas différer sensiblement et, sur une des excellentes planches photographiques exécutées d'après quelques-unes des boîtes de la collection R. Oberthür, on peut se rendre compte que l'aspect général n'est pas très différent. D'après la figure de Leuthner, le dessin des élytres est tout à fait pareil. Si nous retrouvons, à Malacca, la femelle de *O. elegans*, l'objection des " 800,000 kilomètres carrés " qui justifient, aux yeux de M. Möllenkamp, la séparation, sans comparaison, de deux espèces aussi voisines se trouve également très affaiblie, car il y a une bonne distance, me semble-t-il, entre Carin Cheba et Malacca.

Sans affirmer l'identité ou la différence des deux espèces, ce que l'examen du type de *O. mouhoti* permettrait seul de faire, je tiens à dire que l'opinion de M. Zang praraît au moins aussi fondée que celle de son contradicteur.

Odontolabis lowei Parry, Trans. Ent. Soc. Lond., 1873, p. 336, pl. 5, fig. 1.—Le type figuré, conservé au British Museum, ne diffère pas des spécimens reçus de Kina-Balu à une époque récente.

Chalcodes carinatus Linn., Syst. Nat., i, 2, 1735, p. 560. On sait que H. Deyrolle a cru pouvoir séparer en trois espèces distinctes le *C. carinatus* L.: *C. cingalensis* Parry, *C. intermedius* Deyr. et *C. nigritus* Deyr. Les collections du British Museum contiennent un bon nombre de spécimens de ces diverses formes, qui ne sont d'ailleurs pas rares dans les collections, quoique *C. nigritus* soit certainement moins répandu que *C. cingalensis*. Une carte est jointe à cette série et donne la distribution géographique des trois espèces présumées distinctes. D'après ce document, *C. nigritus* et *C. intermedius* seraient propres à Ceylan, tandis que *C. carinatus*, également représenté à Ceylan, se retrouverait sur toute la côte de Calcutta à Madras.

L'examen d'un grand nombre d'exemplaires me fait admettre qu'il existe certainement deux espèces : *C. carinatus* L. (*cingalensis* Parry) qui est la grande espèce, légèrement pubescente, et *C. nigritus* Deyr., de taille notablement plus faible, très noir, brillant, beaucoup plus anguleux comme contours. Quant au *C. intermedius* Deyr., je ne puis arriver à le considérer comme autre chose que la forme mineure du *C. carinatus*.

Le type du *C. cingalensis* Parry doit se trouver dans la série du British Museum, mais je ne l'ai pas spécialement remarqué ; il n'existe d'ailleurs aucun doute sur l'identification de cette espèce à la suite du travail de Leuthner.

Chalcodes aeratus Hope, Trans. Zool. Soc., 1835, p. 99, pl. 14, fig. 2. Cat., p. 16. Deux mâles types sont conservés à Oxford. Quoique la diagnose du catalogue indique comme provenances Tenasserim et Pr. Wales Isl., un de ces exemplaires porte l'indication de localité " Khasyah Hills " qui résulte sans doute d'une confusion.

Neolucanus saundersi Parry, Trans. Ent. Soc. Lond., 1864, p. 20, pl. 9, fig. 3. Les types de cette espèce sont conservés dans la collection R. Oberthür ; il existe cependant, dans la collection du British Museum un petit mâle étiqueté : " Bowring, 63, 47, India " qui porte la mention manuscrite de Parry : " *Saundersi*, priodont type." Cet insecte est un *N. lama* Ol. La femelle qui l'accompagne, provenant également des chasses de Bowring, est aussi *N. lama*.

Neolucanus baladeva Hope, Trans. Linn. Soc., 1843, p. 105. Cat. p. 17.—Les deux types mâles et le type femelle existent dans la collection d'Oxford. Ce sont des *N. lama* Olivier, ainsi qu'on l'admet d'ailleurs généralement. Le plus grand mâle vient de Khasyah Hills. Le deuxième porte la mention : " *Ursus* Lap. descriptio nec figura convenit," observation également faite dans la diagnose. (*N. ursus* Lap. est *O. bellicosus* femelle.)

Neolucanus angulatus Hope, Cat., pp. 17, 18. Cette espèce a été considérée par Parry (Cat. 1864, p. 78) comme représentant la forme mineure de *N. lama* ou *baladeva*. Cette opinion a toujours été considérée comme correcte. Le doute, cependant, était permis. Il existe certainement deux espèces, confondues dans les collections sous le nom de *lama* et qui, toutes deux, sont reçues des mêmes localités. La plus grande, plus large et plus plate, présente, chez les grands mâles, une dent supérieure dressée à l'extrémité

des mandibules. Celles-ci sont donc fourchues. La plus petite, plus étroite, plus parallèle, n'a jamais, même chez les plus forts exemplaires, aucune trace de dent apicale dressée, les mandibules sont simples à la pointe. La grande espèce a les canthus oculaires saillants, souvent très anguleux et même épineux, la tête toujours très plate, le métasternum ne porte aucune dépression. La petite espèce a les canthus plus arrondis, ne formant jamais une saillie épineuse, la tête est plus renflée en dessus et par derrière, le métasternum porte toujours une dépression en lozange très marquée. Des différences analogues permettent de séparer aisément les femelles : celles de la petite espèce sont bien plus faibles, plus étroites et surtout elles présentent toujours la dépression caractéristique du métasternum.

Leuthner, dans sa remarquable monographie, a signalé qu'il y avait une différence d'aspect entre les grands et les petits spécimens de *N. lama ;* il a même figuré une femelle de la petite espèce, mais il n'a pas vu les différences constantes qui séparent les deux formes ; il se borne à dire que Hope a nommé *Lucanus angulatus* la petite forme, qu'il considérait comme une espèce distincte. (Leuthner, Monographie, p. 431.)

Ayant depuis assez langtemps reconnu l'existence des deux espèces, je m'étais toujours demandé si le type de *N. angulatus* Hope appartenait bien à la plus petite ; je pensais être immédiatement fixé à Oxford, mais il n'en a pas été tout à fait ainsi.

L'insecte indiqué comme *angulatus* type dans la collection du Musée est un petit mâle de la petite espèce ; il mesure seulement (la tête un peu inclinée) 36 mm. Ce spécimen porte l'indication : " *Angulatus* Hope " " ? *baladeva* var." Ce n'est évidemment pas le spécimen mentionné dans la diagnose comme ayant 21 lignes.

Deux femelles, de la même espèce, sont avec ce mâle ; elles mesurent 36·5 mm. et sont indiquées de Khasyah Hills, étiquettes anciennes ; elles dépassent un peu la mesure de 16 lignes indiquée par la diagnose : 16 lignes.

Deux autres mâles, plus grands, conservés dans la même série que les insectes précédents, ont la même étiquette "Khasyah Hills" ; ils mesurent respectivement 41 et 45 mm. (environ $19\frac{1}{2}$ et $21\frac{1}{4}$ lignes), mais ils appartiennent à la grande espèce.

Par contre, il existe encore deux mâles de la petite espèce,

dont un seul porte une étiquette ancienne "K. Hills." L'autre paraît plus récemment reçu. Il est à remarquer que le premier a son épingle coupée de la même manière que celle du petit mâle type ; c'est un insecte réparé, recollé, qui a pu perdre une partie de ses étiquettes anciennes ; il mesure 45·5 mm. (environ 21½ lignes), ce qui concorde sensiblement avec l'indication du catalogue.

Leuthner indique 40 mm. comme longueur du *N. angulatus* Hope, mais il ne dit pas que la mesure s'applique au type.

Toutes les probabilités me paraissent être pour que le type véritable soit le mâle de 45·5 mm., mais il y a cependant une petite chance pour que ce soit un des mâles de l'autre espèce. Au British Museum, il existe quatre mâles anciens de la petite espèce, et les indications qu'ils portent viennent à l'appui de la première hypothèse. Un des mâles qui paraît avoir été étiqueté par Westwood porte : "*Angulatus*, Hope's Collect." : un autre, "*Angusticollis*, Hope's coll." Le troisième, par contre, est étiqueté, "*Chalcodes*? *Baladeva* Hope."

Je crois, en définitive, que l'on peut admettre l'identification de la petite espèce au *N. angulatus* Hope (Westwood) et je propose en conséquence de lui restituer ce nom.

En plus des insectes mentionnés ci-dessus, se trouve, à Oxford, un spécimen qui correspond à la dernière phrase de la diagnose : "Varietas Assamensis mandibulis parum brevibus . . . etc." Cet insecte est un *N. saundersi* Parry, de forme mineure. Il porte d'ailleurs une mention qui paraît être de Leuthner : "*Saundersi* Parry nec Hope ♂."

Neolucanus glabratus De Haan, inédit ; Hope, Cat., p. 18. Albers a parfaitement indiqué que la diagnose du *Lucanus laticollis* Thunberg ne pouvait s'appliquer à un *Neolucanus* et que la synonymie donnée par Reiche entre les deux espèces était inexacte. Cette espèce est représentée à Oxford par plusieurs spécimens, dont deux mâles indiqués comme types. Le plus grand seul correspond aux dimensions données par la diagnose, mais tous deux portent une étiquette ancienne "*Glabratus* De Haan." Un troisième mâle, plus petit, a en plus la mention "Java, Burm." Une femelle porte la même étiquette que les deux premiers mâles. La provenance Assam doit être le résultat d'une erreur.

Deux autres femelles, indiquées comme "*Dorcus puncticeps* Hope" sont aussi des *N. glabratus* Hope.

Neolucanus nitidus Saunders, Trans. Ent. Soc. Lond., 1854, pl. 4, fig. 1.—Trois de ces insectes figurent dans la collection d'Oxford et ont tous les mandibules arrachées, procédé pour tuer les insectes spécialement peu recommandable pour les lucanides. Le plus grand mâle, qui est l'exemplaire figuré, est le seul portant l'étiquette: "*Odontolabi*(*s*) *niti*(*dus*) *m*(*ihi*)" tronquée; c'est le vrai type, il mesure 38 mm., les deux autres ont respectivement 35 et 32 mm. Le premier a une indication de provenance: "Shangaï, Mr. Fortune."

Cette espèce est restée peu commune. D'après les mâles que je possède, les mandibules sont assez courtes, elles portent une fourche à l'extrémité apicale et quatre forts denticules sur leur longueur. Mes exemplaires ne sont pas très développés, leur taille est un peu plus faible que celle du type figuré, qui n'est probablement pas lui-même un réellement grand exemplaire. La femelle est assez allongée, régulièrement ovalaire, moins brillante sur les élytres que les mâles, les angles latéraux du prothorax sont légèrement arrondis, les canthus oculaires sont très arrondis, ainsi que le contour externe des mandibules. Mes spécimens sont du Fokien.

Neolucanus championi Parry, Trans. Ent. Soc. Lond., 1864, p. 20.—La collection d'Oxford possède plusieurs spécimens de cette espèce. Le plus grand mâle est le type de Parry, il appartient à la forme majeure; les trois autres mâles, ainsi que la femelle, viennent également de la collection Parry; la femelle a été décrite et figurée par Leuthner, avec le grand mâle (Monogr. p. 428, pl. 85, figs. 8 ♂, 6 ♀).

Le grand mâle ressemble beaucoup à un *N. opacus* Boil. qui serait entièrement dépoli et de forme grêle. Les canthus sont tout à fait arrondis. La dent supérieure apicale est forte et se relie à la dent inférieure par une courbe peu concave.

Parry a indiqué (*loc. cit.*) que le type avait été envoyé de Hong-Kong par le Major Champion, mais que d'autres spécimens avaient été depuis rapportés de l'intérieur de la Chine par Mr. Fortune. Des quatre spécimens d'Oxford, le premier, le troisième et le quatrième mâle, ainsi que la femelle, sont de Hong-Kong. Le deuxième mâle a comme provenance "China or Thibet," c'est un petit spécimen et son attribution à l'espèce est peut-être un peu douteuse. Les exemplaires du *N. championi* du British Museum,

assez nombreux, sont de la provenance " Victoria Peak—Hong-Kong."

Neolucanus sinicus Saunders, Trans. Ent. Soc. Lond. 1854, p. 48, pl. 4, figs. 2, ♂, 3, ♀.—Trois mâles indiqués comme rapportés par Mr. Fortune; le plus grand est indiqué comme type; il mesure 37 mm.; un autre, un peu plus petit, porte les mêmes étiquettes anciennes. La femelle d'Oxford n'est pas le type. Je crois les vrais types au British Museum, mais ne les ai pas revus.

Neolucanus parryi Leuthner, Monographie, p. 424, pl. 85, fig. 4. Deux exemplaires, au British Museum, dont le type, qui vient de Siam. L'autre spécimen, qui vient du Laos (Mouhot) diffère légèrement du type et se rapproche davantage du *N. leuthneri* Boil.

Neolucanus marginatus Waterhouse, Ent. Monthly Mag., 1873, p. 53. La femelle type est au British Museum, ainsi que le mâle considéré par Mr. Waterhouse comme se rapportant probablement à cette espèce. Ce dernier exemplaire porte l'indication de provenance " Lacken, Sikkim. 9000 feet." J'ai déjà signalé (Bull. Soc. Ent. Fr., 1899, p. 178) à la suite d'une communication verbale de M. R. Oberthür, que cet insecte n'était certainement pas le mâle du *N. marginatus*, qui est aujourd'hui bien connu, et qui est bicolore, comme sa femelle. Mais croyant que cet insecte était distinct, j'avais proposé de lui donner le nom de son descripteur, Mr. Waterhouse, nom sous lequel il figure dans le catalogue de Van Roon. (Coleopt. Catal. Jung. pars 8, p. 16.) Après avoir examiné le type, je ne vois pas de caractère permettant de le séparer du *N. lama* Ol.; c'est, à ce qu'il me semble, un très petit exemplaire de cette espèce.

Je ne crois pas non plus que les deux petits mâles bicolores conservés au British Museum soient des *N. marginatus*.

Neolucanus castanopterus Hope, in Gray, Miscell. Zool., 1831, p. 22: Cat., p. 18.—Le type est un mâle moyen, provenant du Nepaul, envoyé par le Général Hardwicke. U. O.

Hemisodorcus nepalensis Hope, in Gray, Zool. Miscell., i, 1831, p. 22: Cat. p. 19.—Le type mâle appartient à la forme moyenne; la femelle est également conservée à Oxford.

Hemisodorcus parryi Hope, Proc. Ent. Soc. Lond., 1843, p. 94: Cat. p. 20. Le type mâle est un *H. nepalensis* de forme mineure et de petite taille; la femelle type est également très petite. U. O.

Hemisodorcus rafflesi Hope, Trans. Linn. Soc., 1842, p. 588, est un grand mâle de *H. nepalensis*, forme majeure. U. O.

Hemisodorcus similis Hope, in Gray, Zool. Miscell. i, 1831, p. 22. D'après la diagnose, le type serait au British Museum; je n'ai pu le retrouver. Au contraire, il est indiqué par le musée d'Oxford comme faisant partie de sa collection. L'insecte ainsi désigné comme type est un *H. nepalensis* plus petit mais de plus grand développement mandibulaire que le *H. nepalensis* type. Les étiquettes anciennes semblent bien indiquer que cet insecte est le type du *H. similis*.

Parry (Cat., 1864, p. 86) a indiqué toutes ces synonymies, qui prouvent, une fois de plus, combien certains descripteurs ont de facilité à fractionner les espèces.

Hemisodorcus macleayi Hope, Cat., p. 19. Le type est un mâle de très grande taille pour l'espèce, de forme majeure. U. O.

Digonophorus atkinsoni Waterhouse, Ann. Mag. Nat. Hist., 1895, p. 157.—Un mâle (type ou cotype ?) est conservé au British Museum. J'ai déjà indiqué, d'après l'avis de M. R. Oberthür, que cet insecte était *Hemisodorcus elegans* Parry (voir Bull. Soc. Ent. Fr., 1899, p. 178). Cette espèce a une certaine affinité avec *Macrodorcus rubrofemoratus* Voll.

Hemisodorcus passaloides Hope, Cat., p. 24.—Le type femelle de cette petite espèce est conservé à Oxford.—Cet insecte est assez difficile à classer; il se rapproche des *Prosopocoelus* du groupe du *cilipes* Thomson par plusieurs caractères, mais ses affinités semblent plus réelles avec le *Ditomoderus mirabilis* Parry.

Ditomoderus mirabilis Parry, Trans. Ent. Soc. Lond., 1864, p. 45, pl. 12, figs. 6, 6*a*–6*e*. Le type mâle de cette intéressante espèce, certainement plus près des Cladognathides que des Dorcides vrais, se trouve au British Museum; c'est un très fort exemplaire, de Bornéo. Il est accompagné d'une instructive série de six autres spécimens, dont plusieurs de très petite taille, et de quatre femelles. Un des mâles, le quatrième comme grandeur, qui a aussi appartenu à Parry, montre une dissymétrie mandibulaire assez nette. Un mâle est de Sarawak, plusieurs de Penang.

Eurytrachelus briareus Hope, Cat., p. 20.—Cet insecte a été rapporté à *E. bucephalus* Perty par Parry (Cat., 1864,

p. 87). La description de Hope, surtout en ce qui concerne les saillies intermandibulaires et les mandibules elles-mêmes semblent en effet s'appliquer à cette espèce. J'ai bien cherché le type à Oxford. Le seul insecte portant l'étiquette "*Briareus* Hope" est un *Titan*, étalé avec les ailes ouvertes, dans la position du vol. C'est un exemplaire assez grand. Il ne porte aucune indication de provenance, mais une étiquette "Cantor" ferait supposer que c'est un exemplaire de l'Inde. Je doute beaucoup que ce soit le type, qui est probablement perdu.

Eurytrachelus tityus Hope, Proc. Ent. Soc. Lond., 1842, p. 83. Un mâle, assez grand, et bel exemplaire, est conservé à Oxford, c'est très probablement un cotype ou un exemplaire typique offert par Parry, d'après l'étiquette que porte cet insecte. Le catalogue de la vente de la collection de Parry, annoté par A. Sallé, semble indiquer que les types du *E. tityus* ont dû être acquis pour le British Museum, où je ne les ai pas remarqués.

Eurytrachelus falco Hope, Cat., p. 6.—L'insecte indiqué à Oxford comme type de cette espèce est un *E. tityus* de forme majeure qui porte les étiquettes "*falco* Laporte MSS." "falco Laporte ?" Le *E. falco* est simplement mentionné p. 6 du Catalogue et n'a été décrit ni par Laporte de Castelnau, ni par Hope ou Westwood.

Eurytrachelus punctilabris Hope, Proc. Ent. Soc. Lond., 1842, p. 84 : Cat. p. 21.—Parry (Cat., 1864, p. 88) a rapporté cette espèce à *E. reichei* Hope. Je ne puis me ranger à son opinion. Le type, conservé à Oxford, a les mandibules grêles armées de deux dents intermédiaires à peine indiquées, qui caractérisent les mâles mineurs de *E. tityus*. Il appartient certainement à cette espèce. [Pl. IX, fig. 11, mandibule.]

Eurytrachelus reichei Hope, Proc. Ent. Soc. Lond., 1842, p. 83 : Cat., p. 21.—Trois mâles sont étiquetés comme types à Oxford ; ils mesurent 52, 51 et 47 mm. et sont tous trois indiqués de "K. Hills." Un autre spécimen, mesurant 50 mm. porte aussi une étiquette de Hope "*Reichei* Hope" et la localité "Bengal."

Eurytrachelus lineatopunctatus Hope, in Gray, Zool. Miscell., i, 1831, p. 22 : Cat., p. 23.—La description de l'espèce parle de mâles et de femelles. Il n'y a, à Oxford, que des femelles indiquées comme types de cette espèce. Toutes trois paraissent être du Nepaul, deux sont explicitement indiquées de cette provenance. Bien qu'il soit fort

difficile de distinguer les femelles de *E. tityus* de celles de *E. reichei*, je considère comme vraisemblable qu'elles se rapportent à cette dernière espèce. Parry les a, au contraire, rapportées à *E. tityus* (Cat., 1864, p. 87). A l'appui de mon opinion vient la description donnée par Hope des mâles venus avec ces femelles : dont la phrase suivante est applicable à *E. reichei*, mais non à *E. tityus* : " mandibulis maris capitis longitudine falcatis dente parvo conico ante medium interdum fere obsoleto . . ."

Eurytrachelus blanchardi Hope, Proc. Soc. Ent. Lond., 1842, p. 84 : Cat., p. 21. Le type mâle, conservé à Oxford, est un *E. reichei* Hope, forme moyenne (et non de forme mineure comme l'a indiqué Parry, Cat., 1864, p. 88).

Eurytrachelus rugifrons Hope, Cat., p. 24.—Comme l'a indiqué Parry (Cat., 1864, p. 87) la femelle type appartient à *E. bucephalus* Perty. Elle porte les indications " *rugifrons* Hope," " *subcostatus* Dup. Java." Une autre femelle est étiquetée " *subcostatus* De Haan." U. O.

Eurytrachelus candezei Parry, Trans. Ent. Soc. Lond., 1870, p. 90, pl. 1, fig. 2. Le type, figuré par Parry, est conservé à Oxford. Parry a reconnu son identité avec *E. eurycephalus* Burmeister (*loc. cit.*, 1874, p. 371). Les curieuses impressions du pronotum sont parfaitement symétriques. On peut les expliquer par la déformation produite par les mandibules d'un autre mâle alors que le premier exemplaire n'était pas absolument solidifié, mais cette hypothèse est discutable. Il arrive assez souvent que les petits mâles et les femelles du *L. cervus* présentent des dépressions symétriques sur le pronotum.

Eurytrachelus chevrolati Hope, Proc. Ent. Soc. Lond., 1842, p. 84 : Cat. p. 20.—Le type est un grand mâle de *E. gypaëtus* Castelnau comme l'a indiqué Parry (qui supposait *E. saiga* identique à ces insectes). C'est un exemplaire de forme assez lourde, avec des mandibules moyennement allongées. Il porte l'étiquette de provenance " Khasyah Hills," s'accordant avec l'indication du descripteur et certainement inexacte. U. O.

Eurytrachelus dubius Hope, Cat., p. 21. Deux mâles types sont conservés à Oxford. Le plus grand mesure 19½ lignes, l'autre 18 lignes (environ 41·5 et 38 mm.). Ce sont des *E. gypaëtus* Cast., de forme moyenne, dont les mandibules portent encore des soies, et non des spécimens de forme mineure. La provenance des deux exemplaires est " Java," contrairement à l'indication de la diagnose.

Eurytrachelus incertus Hope, Cat., p. 22. Deux mâles sont indiqués comme types à Oxford. Ils appartiennent tous deux à la forme moyenne, l'un de *E. gypaëtus* Cast., l'autre de *E. cribriceps* Chevrolat. Le premier est étiqueté "Java," le deuxième, et une femelle placée avec lui, "Manille." Le *gypaëtus* est le plus grand des deux.

Eurytrachelus indeterminatus Hope, Cat., p. 22. C'est un petit mâle de *E. gypaëtus*, appartenant à la forme *capito* Albers. Provenance "Java." U. O. Sous le nom inédit de *Dorcus megacephalus* Gory, est conservé également un autre mâle *capito* plus grand.

Eurytrachelus javanus Hope, Cat., p. 6. Cet insecte, cité, mais non décrit dans le Catalogue, se trouve à Oxford, c'est une femelle de *E. gypaëtus*.

Eurytrachelus moloschus Hope, Cat., p. 21. Trois exemplaires, deux mâles (types) et une femelle, conservés à Oxford. Ce sont des *E. cribriceps*, comme l'a reconnu Parry (Cat. 1864, p. 88). Un mâle et la femelle portent l'indication "I. Phillip. de Cuming MSS.," l'autre mâle "Manille, coll. Miers."

Eurytrachelus submolaris Hope, Cat., p. 23. Le mâle type est conservé à Oxford. C'est un exemplaire de petite taille, qui a été indiqué par Parry comme espèce distincte, dans son premier Catalogue, puis simplement supprimé dans les suivants. Il figure dans le premier sous le nom de *Dorcus submolaris* Hope et le *D. bengalensis* Hope est donné comme étant sa variété mineure. Je reviendrai sur cette deuxième espèce.

Le type du *submolaris* [Pl. IX, fig. 10 mandibule] est un mâle de 31·5 mm. envoyé par Cantor, de l'Assam. C'est un insecte parfaitement distinct de *E. reichei* et de *E. tityus*, mais apparenté à ce dernier. J'ai pu en réunir une vingtaine d'exemplaires dans ma collection; ils sont très homogènes quoique variant de provenance. C'est à cette espèce que se rattache mon *Dorcus brachycerus* (Bull. Soc. Ent. Fr., 1904, p. 27) du Kaschmyr, quoiqu'il ne me paraisse pas identique aux spécimens de l'Assam. Il constitue vraisemblablement une forme locale ou une variété, ce que je ne puis affirmer absolument, n'en ayant que de petits développements. Je possède, au contraire, d'assez grands mâles de *E. submolaris*, mais non encore la forme majeure. Tous les spécimens se distinguent par une forme robuste et ramassée, les élytres sont à peine striées latéralement, même chez les plus petits mâles. Les

contours de la tête sont remarquablement arrondis. L'armature mandibulaire des mâles moyens ressemble beaucoup à celle de *E. tityus*, mais la mandibule est plus courte et plus large.

Eurytrachelus (?) *bengalensis* Hope, Cat., p. 22. Le type mâle est conservé à Oxford. C'est un petit spécimen, de la taille d'un petit *Dorcus parallelepipedus* L.; ses élytres sont presque tout à fait dépourvues de strioles qui n'existent que sur les côtes; elles sont assez finement ponctuées; la tête est assez large, les mandibules ont une dent basale simple. Ces caractères suffisent pour prouver que *E. bengalensis* ne peut être *E. reichei* min., puisque les élytres ne sont pas striées; il ne peut être ni *E. tityus* ni *E. submolaris*, comme l'avait supposé Parry (Cat. 1864, p. 89), puisque chez les petits mâles de ces espèces il n'y a pas de dent basale à la mandibule.

Je pense qui si cet insecte est la forme mineure d'une espèce déjà nommée, ce serait plutôt avec *D. glabripennis* Westwood qu'il conviendrait de vérifier ses affinités, mais je ne connais pas, d'une manière certaine, les petits développements de cette rare espèce.

Eurytrachelus wickhami Waterhouse, Ann. Mag. Nat. Hist., 1894, p. 283. Type mâle au British Museum.

Eurytrachelus pilosipes Waterhouse, Trans. Ent. Soc. Lond., 1883, p. 447, pl. 21, fig. 1. Les deux mâles conservés au British Museum, types de l'espèce, rappellent entièrement l'*E. intermedius* Gestro dont ils ne diffèrent que par les mandibules. D'après les spécimens de cette espèce qui ont été reçus plus récemment, elle semble co-exister aux I. Salomon avec l'*E. intermedius.*

Dorcus antaeus Hope, Proc. Ent. Soc. Lond., 1842, p. 83: Cat., p. 20. Le type est un bel exemplaire mâle de "K. Hills." U. O.

Dorcus mercurius Hope. Sous ce nom, inédit, figurent à Oxford deux petits mâles de l'espèce précédente.

Dorcus scaritoides Hope, Cat., p. 24. La femelle type de cette espèce est un *D. antaeus* Hope de faible taille provenant, comme le mâle, de "K. Hills." Elle porte une étiquette: "*Antaeus* ♀? *tityus* ?" Parry a indiqué, avec doute (Cat., 1864, p. 90), l'identité présumée de *D. scaritoides* et de *D. antaeus.* Il a simplement supprimé cette espèce dans ses deux autres Catalogues.

Dorcus de haani Hope, Trans. Linn. Soc., 1843, p. 106: Cat. p. 22.—Le musée d'Oxford possède un mâle cotype

de cette espèce, et le type femelle. Le mâle est un petit spécimen à élytres striées régulièrement. Il porte les indications : " Khasyah Hills " et " *De Haani* Hope." La femelle a les mêmes étiquettes.

Dorcus curvidens Hope, Trans. Linn. Soc., 1842, p. 589 : Cat. p. 22. Le type est conservé à Oxford. Il porte les indications suivantes : " Assam, S. Jones " " *Curvidens* Hope " " *Antaeus* var. ♂." Cet insecte est un mâle de *D. de haani*, de forme moyenne, avec les côtés des élytres striés. Parry a donné la synonymie : *Curvidens = de haani* var. min. (Cat., 1864, p. 88). En réalité, *D. curvidens* est le vrai nom de cette espèce. Non seulement la description du *D. curvidens* est antérieure d'une année à celle du *D. de haani*, mais encore, des deux spécimens décrits, c'est sans aucun doute *de haani* qui appartient à la forme la moins développée. La longueur indiquée pour *D. curvidens* est 21 lignes, celle donnée pour *de haani* est seulement 17 lignes. La description des élytres montre bien d'ailleurs que la différence signalée plus haut entre *D. curvidens* et *D. de haani* cotype existait de même avec *D. de haani* type. Le nom de *de haani* doit, régulièrement, passer en synonymie.

Dorcus glabripennis Westwood, Trans. Ent. Soc. Lond., 1871, p. 359, pl. 8, fig. 6. Le type, conservé au British Museum, ressemble peu à la figure, bien que Westwood ait été, en général, un dessinateur aussi habile qu'exact. Les côtes élytrales sont peu apparentes et les élytres sont, en réalité, assez lisses et brillantes. Un mâle plus petit, étiqueté par Parry " var. minor " de " Khasyah Hills " ressemble à un *E. brachycerus* ou *submolaris*, ses élytres sont brillantes, sans côtes ou stries plus apparentes que chez le type.

Dorcus vicinus Saunders, Trans. Ent. Soc. Lond., 1854, p. 51, pl. 4, fig 9. Type au British Museum, où la femelle se trouve également conservée.

Dorcus suturalis Westwood, Trans. Ent. Soc. Lond., 1871, p. 358, pl. 8, fig. 5. Type mâle au British Museum. Les femelles n'appartiennent pas à cette espèce; ce sont des femelles de *E. brachycerus*. Le *D. suturalis*, qui a été récemment reçu en assez fortes séries, est apparenté à l'espèce suivante.

Dorcus ratiocinativus Westwood, Trans. Ent. Soc. Lond., 1871, p. 356, pl. 8, fig. 2.—Cette espèce a été reçue en nombre par M. R. Oberthür il y a une douzaine d'années,

ce qui a permis de connaître la femelle. Les spécimens ainsi reçus sont, d'une manière générale, plus grands que le type du British Museum, mais lui ressemblent très exactement.

Dorcus rudis Westwood, Trans. Ent. Soc. Lond., 1864, p. 35, pl. 9, fig. 4, 4*a*–4*g*. Le type femelle de cet insecte est conservé au British Museum. *D. rudis* a toujours été un peu une énigme pour les spécialistes. On en reçoit, quoique rarement, des exemplaires isolés. J'en ai vu un à Bruxelles (Museum) et j'en ai réuni quatre dans ma collection. Mais le mâle reste introuvable, soit que nous le connaissions déjà et que nous ne sachions pas reconnaître ses affinités avec sa femelle, soit qu'il n'ait pas encore été envoyé en Europe.

Le dernier catalogue des Lucanides, dû à M. van Roon, me prête une énormité dont je crois être incapable en m'attribuant la synonymie inattendue *D. rudis* = *D. derelictus* Parry. Je ne sais où M. van Roon a trouvé ce renseignement.

Dorcus derelictus Parry, Proc. Ent. Soc. Lond., 1862, p. 112.—Le type est également au British Museum. Comme *D. rudis*, *D. derelictus* a exercé la sagacité des spécialistes, mais je crois que ses affinités sont beaucoup plus certaines et, après avoir examiné le type, je maintiens entièrement l'opinion que j'ai donnée autrefois (Mem. Soc. Ent. Belg. 1902, p. 58) que cet insecte est la femelle d'un Dorcide très voisin de *Macrodorcus rubrofemoratus* Voll. Le spécimen du British Museum est d'un noir franc, avec reflets soyeux, dans le genre des femelles de *Rhaetus westwoodi*. Les pattes antérieures sont cintrées concaves extérieurement. Les fémurs ne sont pas tout à fait noirs, mais ont une faible teinte rougeâtre, l'extrémité des tibias antérieurs est tout à fait du même modèle que chez *M. rubrofemoratus*. J'ai vu deux autres spécimens, qui m'ont été communiqués par M. Möllenkamp et qui ne me paraissent pas différer du type. L'espèce est plus grande que *Macrodorcus* (*Hemisodorcus*) *rubrofemoratus*, mais voisine de cette espèce et de *H. arrowi* Boil.

Macrodorcus opacus, Waterhouse, Ent. Monthly Mag., 1870, p. 208, est bien, comme l'a indiqué Lewis, un mâle de grand développement de *M. striatipennis* Motschulsky. B. M.

Metallactulus parvulus Hope, Cat., p. 25. Les types de Hope conservés à Oxford sont deux femelles, provenance "Manille."

Gnaphaloryx squalidus Hope, Cat., p. 19. Les types, un mâle et une femelle, sont également à Oxford.

Gnaphaloryx sculptipennis Parry, Trans. Ent. Soc. Lond., 1864, p. 52. Le type mâle, qui se trouve au British Museum, est un petit exemplaire.

Eulepidius luridus Westwood, Trans. Ent. Soc. Lond., 1874, p. 357, pl. 3, fig. 1. Le type de ce rare insecte est conservé à Londres. Je pense que sa place est bien à côté des *Gnaphaloryx*, mais ceux-ci ne sont pas correctement classés dans les Dorcides.

Aegotypus trilobatus Parry, Proc. Ent. Soc. Lond., 1862, p. 113. Il a été décrit trois espèces d'*Aegotypus*. L'*Ae. trilobatus* est nettement distinct d'*Ae. armatus* Boil. Il se rapproche beaucoup plus d'*Ae. lobicollis* Jakowleff ou, tout au moins, de l'espèce de Kina-Balu qui est répandue sous ce nom. Le grand mâle d'*Ae. trilobatus* porte une crête frontale bien développée. La saillie antérieure du prothorax est lobée comme chez les exemplaires de Kina-Balu. La femelle est seulement ondulée sur les côtés du prothorax; cette forme varie un peu suivant les spécimens chez *Ae. lobicollis*. L'écart des deux espèces est très faible, s'il existe.

Aegus chelifer MacLeay, Horae Ent., 1819, p. 113.—Le British Museum possède un spécimen qui, d'après Parry (Cat. 1864, p. 54), aurait été envoyé par Mr. MacLeay lui-même, avec l'indication de l'habitat "Australia" sur son étiquette. Parry, dans la note qu'il consacre à cette espèce, identifie ce spécimen avec ceux reçus par Mniszech et lui-même du Cambodge et de la péninsule Malaise.

Au Cambodge existe une assez grande espèce, voisine d'*Ae. acuminatus* Fab. mais ayant les mandibules armées d'une dent toujours simple, assez avancée vers l'apex, et les élytres brillantes sur les côtés. Par contre cette espèce ne semble pas se trouver en Malaisie. Elle a été décrite par Jakowleff, sous le nom d'*Aegus specularis* (Horae Soc. Ent. Ross., 1900, p. 633). Une autre espèce, plus petite, répond également à la description donnée par Parry dans sa note. Elle diffère davantage que la précédente d'*Aegus acuminatus*, et a les intervalles des élytres bombés au lieu d'être plats. La distribution géographique semble assez large. Bornéo, Malacca, sont ses provenances les plus certaines. Quelques exemplaires sont indiqués de Java, sans grande certitude, et de Sumatra. J'ai décrit cette espèce sous le nom d'*Aegus nitidus* (Bull. Soc. Ent. Fr.,

1899, p. 321), pensant, d'après la provenance : " Cambodge " que le véritable *Aegus chelifer* devait être la grande espèce indo-chinoise. L'examen du spécimen cotype d'*Aegus chelifer*, conservé au British Museum, montre immédiatement que c'est à cette dernière espèce qu'il se rapporte. L'insecte porte les indications suivantes : " *Aegus chelifer* MacLeay," " Australasia, 1736," " Chelifer, 1736." Ce spécimen se rapproche davantage de ceux reçus de Singapore que de ceux reçus de Bornéo. Sans discuter l'indication " Australasia " qui reste douteuse, nous devons considérer ce cotype comme vraisemblablement correct et mettre l'*Ae. nitidus* en synonymie.

Aegus platyodon Parry, Proc. Ent. Soc. Lond., 1862, p. 112.—Le type (British Museum) de cette espèce est un assez grand mâle, provenant de Gilolo, par Wallace. Cette espèce varie un peu suivant les localités. Le type a le pronotum assez brillant, le dessous du menton et le sous-menton sont couverts d'une ponctuation cicatricielle confluente.

Aegus blandus Parry, Trans. Ent. Soc. Lond., 1864, p. 57. Le type mâle, conservé au British Museum est, je crois, toujours l'unique exemplaire connu. C'est un insecte d'aspect très distinct, allongé, avec une grosse tête et de courtes mandibules simples, armées d'une dent basale également simple ; les intervalles des élytres sont plats, lisses mais peu brillants, le pronotum assez brillant.

Aegus woodfordi Waterhouse, Ann. Mag. Nat. Hist., 1890, p. 38. Types mâle et femelle au British Museum. Le mâle est un petit exemplaire. Les mâles majeurs de cette espèce ont un aspect assez différent. Les mandibules sont toujours velues en dessous.

Aegus glaber Parry, Trans. Ent. Soc. Lond., 1864, p. 59. Le type est un très petit mâle. B. M.

Aegus curtisi Waterhouse, Ann. Mag. Nat. Hist., 1890, p. 36. Type au British Museum. Est apparenté à *Ae. oxygonus* Jakowleff, mais distinct.

Aegus parryi Waterhouse, Ann. Mag. Nat. Hist., 1890, p. 37. Cette espèce est représentée par trois spécimens, qui viennent de la collection Parry et sont, vraisemblablement, d'origines distinctes. Il y a au moins deux espèces différentes sous le même nom.

Le plus grand mâle doit être considéré comme le vrai type ; il a les mandibules terminées par un biseau vertical, la dent basale est bien détachée, oblique, et obliquement

coupée, de sorte qu'elle forme un angle obtus vers la mandibule à laquelle elle appartient et un angle aigu à son extrémité, du côté de l'autre mandibule. Cette forme rappelle beaucoup celle des mandibules de l'*Aegus hopei* Boil., et les deux espèces sont certainement très voisines, sinon identiques, ce que je ne puis affirmer, n'ayant pu comparer les types et n'ayant rapporté qu'un croquis de l'*Ae. parryi.* [Pl. IX, fig. 15, mandibule.] Celui-ci est indiqué de Sarawak. *Hopei* est de Palembang.

Le deuxième exemplaire me semble identique à mon *Ae. westwoodi*; il en a la dent basale simple et la forte carène apicale des mandibules. [Pl. IX, fig. 16, mandibule.] Le troisième exemplaire, d'après un croquis envoyé autrefois à M. Ritsema, qui me l'avait communiqué, était un petit spécimen avec mandibules aiguës à la pointe et dent basale simple, comme les ont les petits spécimens d'*Ae. malaccus* Thomson. Ce type était réduit à l'état de débris lorsque je l'ai vu en nature. B. M.

Aegus roepstorffi Waterhouse, Ann. Mag. Nat. Hist., 1890, p. 36. Les types, conservés au British Museum, sont des Îles Andamans. La même espèce existe aux Iles Nicobar.

Aegus subnitidus Waterhouse, Ent. Monthly Mag., 1873, p. 277. Le type est un petit mâle à dent basale aiguë. B. M.

Aegus kandiensis Hope, Cat., p. 6 : Parry, Trans. Ent. Soc. Lond., 1870, p. 61, pl. 2, figs. 5–8. Cette espèce, que Parry a bien voulu considérer comme attribuable à Hope, qui l'a simplement nommée, et à tort, comme un synonyme d'*Ae. cicatricosus* Wied, lui-même forme mineure d'*Ae. acuminatus* Fab., a été, en réalité, décrite par Parry dans son deuxième Catalogue. Le vrai type doit donc être considéré comme étant le grand mâle figuré à cette occasion ; il fut acquis par H. Deyrolle à la vente de la collection ; peut-être se trouve-t-il actuellement dans la collection de M. R. Oberthür.

L'insecte nommé par Hope est conservé à Oxford; c'est un petit mâle, provenance "Kandy." Le pronotum est ponctué et brillant, la dent basale des mandibules est simple.

Aegus parallelus Hope, Cat., p. 22. Le type est conservé à Oxford, il m'a été communiqué et j'ai pu l'examiner avec soin. C'est certainement un petit spécimen appartenant, soit à *Aegus labilis* Westwood, soit à *Aegus platycephalus* Westwood. En raison de la provenance : "Khasyah Hills" il convient de la rapporter à la première de

ces deux espèces et, en raison des dates de description le nom de *parallelus* doit faire passer en synonymie le nom de *labilis*. Westwood a d'ailleurs lui-même admis que *Ae. parallelus* était la forme mineure d'*Ae. labilis* et que *Ae. aequalis* Westwood était très probablement identique à *Ae. parallelus*. (*Vide* Trans. Ent. Soc. Lond., 1864, p. 56.)

Aegus eschscholtzi Hope, Cat., p. 22. Le type mâle appartient au développement maximum. Son étiquette de provenance semble indiquer Java, contrairement à la diagnose qui donne "Tenasserim." U. O.

Aegus striatus Hope, non décrit, est representé à Oxford par un petit mâle d'*Aegus acuminatus* sans indication de provenance.

Aegus fronticornis Hope, également non décrit, est un mâle moyen, provenance "Kandy," d'*Aegus kandiensis* Parry. U. O.

Aegus punctiger Saunders, Trans. Ent. Soc. Lond., 1854, p. 54, dont le type existe à Oxford est, comme l'a indiqué Parry (Cat. 1864, p. 92) la femelle d'*Ae. laevicollis* Saunders.

Alcimus dilatatus Fairmaire, Rev. Zool. 1849, p. 416, pl. 11, fig. 6. M. Waterhouse a décrit la grande forme de cette espèce, dont le type de Fairmaire est un petit spécimen. Le grand mâle, qui faisait partie de la collection Parry est maintenant conservé au British Museum. [Pl. IX, fig. 3.]

Paraegus listeri Gahan, Proc. Zool. Soc., 1888, p. 539. Types mâles et femelles au British Museum. Cette espèce ressemble aux *Aegus lansbergei* et *rotundatus* Boil., et rappelle également certains *Lissotes*.

Apterocyclus honoluluensis Waterhouse, Trans. Ent. Soc. Lond., 1871, p. 315, fig. ♀. Le croquis publié avec la description ne permet pas de se rendre compte de l'aspect de l'insecte, qui ressemble assez à un *Sclerostomus*, de la taille du *S. bacchus*. M. Sharp a publié les descriptions de plusieurs autres espèces dont j'ai vu les spécimens, et qui, à ce qu'il m'a semblé, sont vraiment bien voisines les unes des autres. B. M.

Sclerostomus fairmairei Parry, Trans. Ent. Soc. Lond., 1864, p. 61, type mâle. B. M.

Sclerostomus philippii Westwood, Trans. Ent. Soc. Lond., 1864, p. 61, pl. 11, fig. 5. Types mâle et femelle. Le mâle est un exemplaire moyen. La dent basale tridentée s'atténue beaucoup chez les spécimens de plus grand développement.

Sclerostomus buckleyi Waterhouse, Ann. Mag. Nat Hist., 1886, p. 497. Les femelles, indiquées comme types n'appartiennent pas, à mon avis, à la même espèce que le mâle; elles sont très courtes et larges, ternes, d'une couleur rougeâtre nuancée de noir, avec des strioles et non des stries régulières comme celles du mâle; il y a un angle postérieur épineux très net au prothorax qui n'existe nullement chez le mâle; je ne serais pas éloigné de penser que ces femelles appartiennent au genre *Aegognathus* Leuthner.

Sclerostomus darwini Hope, Ann. Mag. Nat. Hist., 1845, p. 302 : Cat., p. 25. Type mâle conservé à Oxford; paraît être, comme l'a indiqué Parry, *S. femoralis* Guérin, mais n'est pas un grand exemplaire.

Sclerostomus rubripes Hope, Cat., p. 26. La provenance du type mâle est "Magellan," c'est un *S. femoralis* de faible développement. (Parry, Cat. 1884, p. 95.) U. O.

Sclerostomus variolosus Hope, Cat., p. 25. Les types d'Oxford se rapportent bien au *S. caelatus* Blanchard, comme l'a indiqué Parry (Cat., 1864, p. 95).

Sclerostomus bacchus Hope, Cat., p. 26. Type mâle, conservé à Oxford.

Sclerostomus ditomoides Westwood, Trans. Ent. Soc. Lond., 1855, p. 208, pl. 11, fig. 4. La synonymie indiquée par Parry, Trans. Ent. Soc. Lond., 1870, p. 96, ne me paraît pas certaine. Il semble d'ailleurs que Parry ait eu lui-même des doutes à ce sujet, puisque, dans son Catalogue de 1875 il a rétabli, quoique avec doute, *S. neotragus* Westwood = *ditomoides* Westwood (*teste* Parry) comme une espèce distincte de *S. cruentus* Burmeister. U. O.

Scortizus irroratus Hope, Trans. Zool. Soc. Lond., 1835, p. 100, pl. 14, fig. 3. L'insecte conservé comme type à Oxford est un mâle de cette espèce, le vrai type doit être une femelle.

Scortizus costatus Hope, Cat. p. 27. Types mâle et femelle. U. O.

Aegognathus Waterhousei, Leuthner, Trans. Ent. Soc. Lond., 1883, p. 445, pl. 21, fig. 3. La figure qui a été donnée de cet insecte est bonne, mais les mandibules sont dans une position anormale qui en change l'aspect. Les élytres ont l'apparence pruineuse de celles de certains *Sclerostomus*, mais la forme de l'extrémité des tibias, étroite et peu épineuse chez *Aegognathus*, éloigne ces deux genres et rapproche plutôt le dernier des *Auxicerus*, tout en restant très distinct. L'extrémité des mandibules est

coupée en biseau un peu élargi en spatule, avec une trace de denticule anté-apical. B. M.

Charagmophorus lineatus Waterhouse, Ann. Mag. Nat. Hist., 1895, p. 495. Type mâle au British Museum. [Pl. IX, fig. 2.]

Auxicerus platyceps Waterhouse, Ann. Mag. Nat. Hist. 1883, p. 387. Le type est un insecte très gracile, c'est un mâle de développement moyen. Les mandibules portent une trace de la dent d'arrêt placée sur la partie supérieure, un peu au delà du milieu. B. M.

Platycerus caucasicus Parry, Trans. Ent. Soc. Lond., 1864, p. 60. Le type mâle est conservé au British Museum.

Pseudodorcus hydrophiloides Hope, Cat., p. 23. Le mâle de cette espèce énigmatique est conservé à Oxford, la femelle au British Museum. Cet insecte est resté extrêmement rare jusqu'à présent, et peu connu. Le mâle [Pl. IX, fig. 1–1*a*, antenne] a tout à fait l'aspect d'une grosse femelle d'*Eurytrachelus* du groupe de *E. intermedius*, mais plus large, et avec des mandibules beaucoup plus compliquées. La femelle a la même taille que le mâle, mais la tête est un peu plus petite et les mandibules présentent une dent simple vers l'apex. Celles du mâle sont sensiblement égales à la longueur de la tête; elles sont convexes extérieurement, leur pointe est simple; il existe une dent basale double à gauche, simple et projetée vers l'avant à droite, et une dent médiane double placée un peu plus bas à droite qu'à gauche. Le front est concave et brillant, l'épistome forme une saillie conique dont la forme est celle d'une accolade à pointe assez développée, la partie qui avance est en relief sur le reste. L'antenne est bien coudée et ressemble beaucoup à celle d'un grand Dorcide. Le scape est sensiblement égal au fouet. Le 2^{e} article est plus long que le 3^{e}; celui-ci est égal au 5^{e} et plus long que le 4^{e}; le 6^{e} et le 7^{e} sont égaux au 5^{e}. Le 7^{e} est éperonné, l'éperon est conique et porte des soies courtes; les trois derniers ont leur surface feutrée, mais le 8^{e} a toute la région dorsale, et le 9^{e} la partie apicale de cette région, brillantes. Le peigne est bien développé.

Les canthus ne coupent pas plus du tiers antérieur de l'œil; celui-ci est gros, sphérique, un peu plus développé en dessous. Le menton est petit, trapézoïdal, avec les angles bien arrondis et le bord antérieur convexe. Il est brillant, avec une forte ponctuation cicatricielle.

Le prosternum est en carène saillante, aplatie, avec deux

impressions distinctes avant le milieu des hanches; il forme ensuite une pointe conique dont les génératrices sont un peu convexes. Le mésosternum est concave. Le métasternum est lisse, un peu déprimé en triangle vers les hanches postérieures.

Les pattes sont assez fines; les tibias antérieurs sont dentés et denticulés en scie entre les dents principales. La fourche apicale est peu caractérisée. Les tibias médians et les postérieurs ont une forte épine aiguë avant le milieu. Les tarses sont assez grêles, plus courts que les tibias, le dernier article a deux fois et demie la longueur d'un des autres. Les soies inférieures sont disposées en deux pinceaux, moins fournis vers le dernier article.

Ce qui sépare le plus nettement, au premier examen, cet insecte des grand Dorcides auxquels on serait tenté de le réunir, c'est la forme de la lèvre supérieure et l'armature compliquée de ses courtes mandibules. A ce point de vue, il se rapproche davantage des Cladognathides. Mais la disposition des pattes, au contraire, avec les fortes épines apicales, rappelle davantage les Dorcides.

J'ai reçu, il y a quelque temps, sans provenance précise, mais venant presque certainement du Queensland, un spécimen de *Pseudodorcus* qui diffère de *P. hydrophiloides* par la dent basale des mandibules qui est double à droite et à gauche, et la dent médiane, qui est simple; son aspect est tout à fait analogue à celui du mâle de l'Ile Melville, mais il est un peu plus petit.

Je n'ai pu examiner la femelle du *P. hydrophiloides*, décrite par Westwood sous le nom de *carbonarius* (Trans. Ent. Soc. Lond., 1863, p. 515, pl. 21, fig. 3) avec autant de soin que le mâle, ce dernier m'ayant été très obligeamment communiqué. Elle me paraît bien, comme l'a reconnu Parry (Trans. Ent. Soc. Lond., 1870, p. 94) appartenir à la même espèce. La figure donnée par Westwood (*loc. cit.*) ne ressemble pas à l'insecte; elle est exacte comme détails, mais la position réelle de la tête est inclinée, de sorte qu'elle est peu visible et que la forme générale paraît presque régulièrement elliptique.

Lissapterus howittanus Westwood, Trans. Ent. Soc. Lond., 1863, p. 513, pl. 21, fig. 1, ♂. Le musée d'Oxford possède deux mâles et deux femelles, types de l'espèce.

Lissapterus pelorides Westwood, Trans. Ent. Soc. Lond., 1855, p. 220. La femelle type, seul spécimen connu de cette espèce, est conservée au British Museum; le dessin

qu'en a donné Westwood (*loc. cit.*, 1863, p. 514, pl. 21, fig. 2) est très exact. L'insecte est noir et lisse, à peu près comme une femelle de *Dorcus antaeus* Hope, et très distinct de *L. howittanus.*

Lissotes helmsi Sharp, Ent. Monthly Mag., 1881, p. 49, type ♂. B. M.

Lissotes capito H. Deyrolle, Trans. Ent. Soc. Lond., 1873, p. 339, pl. 5, fig. 4, ♂ : Parry, *loc. cit.*, p. 339, pl. 5, fig. 5, ♀. Les spécimens du British Museum ne sont pas les types, mais sont intéressants à comparer a l'espèce la plus voisine, *L. helmsi*, les exemplaires de *L. capito* étant fort rares. Le British Museum possède deux mâles et trois femelles. L'espèce est à peine inférieure à *L. helmsi* comme taille. La dent basale pointue des mandibules, qui est latérale chez *L. helmsi* est supérieure chez *L. capito.* Les intervalles des élytres sont plus serrés chez ce dernier et les tibias postérieurs portent une épine qui fait défaut à *L. helmsi.*

Lissotes forcipula Westwood, Trans. Ent. Soc. Lond., 1871, p. 366, pl. 9, fig. 2. Petite espèce, très courte et arrondie. Je serais très disposé à croire que la suivante, dont le type est une femelle, n'en diffère pas réellement. B. M.

Lissotes subcrenatus Westwood, Trans. Ent. Soc. Lond., 1871, p. 368, pl. 9, fig. 5. Le type femelle, originaire de Tasmanie, comme l'insecte précédent, et paraissant apparentée avec lui. B. M.

Lissotes crenatus Westwood, Trans. Ent. Soc. Lond., 1855, p. 216, pl. 12, fig. 3. Le musée d'Oxford possède un mâle et une femelle indiqués comme types. Le mâle appartient à la forme majeure et correspond bien à la description.

Quant à la femelle, qui n'est nullement mentionnée dans la description de l'espèce, je suis disposé à penser que c'est celle décrite plus tard par Westwood sous le nom de *L. forcipula ?* ♀. Trans. Ent. Soc. Lond., 1871, p. 367, pl. 9, fig. 6, *a*, *b*. Elle correspond exactement à cette description et aura sans doute été identifiée postérieurement par Westwood avec *L. crenatus ?* Il est bien certain que les *L. crenatus*, *subcrenatus*, *forcipula* constituent un petit groupe qu'il serait nécessaire de revoir avec soin. Malheureusement, ces espèces sont très mal représentées dans nos collections et nous ignorons l'étendue et la genre de leurs variations spécifiques.

M. A. M. Lea a récemment publié une intéressante étude sur le genre *Lissotes*,* dans laquelle il examine et figure les

espèces australiennes et tasmaniennes dont il a eu connaissance, mais il ne fait que citer *L. crenatus* et *L. subcrenatus* d'après les descriptions originales.

Lissotes latidens Westwood, Trans. Ent. Soc. Lond., 1871, p. 363, pl. 9, fig. 4. Le type mâle de cette rare espèce est conservé à Oxford. Il est très distinct et bien caractérisé.

Lissotes launcestoni Westwood, Trans. Ent. Soc. Lond., 1871, p. 365, pl. 9, fig. 1. Le type se trouve au musée d'Oxford. Il n'est pas explicitement indiqué mais je pense que c'est le spécimen, de taille moyenne et de forme assez étroite, qui porte les étiquettes anciennes : "*Lissotes launcestoni* Westw[d] Howitt" "Lissotes n. sp ? Tasmania, March 1866 two ♂" et "W. Dr. Howitt. N.H." Il existe d'autres spécimens, dont un grand mâle, mais ils ne correspondent pas à la figure. Cette espèce est bien connue et l'une des plus répandues dans les collections.

Lissotes cancroides Fabricius, Mant., i, 1787, p. 2. D'après Westwood, le type même de l'espèce, décrit par Fabricius, fait partie des collections du British Museum. Je ne l'ai pas vu ; aucun des *L. cancroides* ne portait d'indication de type. Dans la collection d'Oxford, le spécimen étiqueté *L. cancroides*, qui m'a été communiqué, porte les indications : "*Cancroides* ♂ Mus. Hope" et une étiquette qui paraît très ancienne : "Van D. Land. Mr. Richard." Cet insecte ressemble beaucoup à un autre *Lissotes*, qui est étiqueté *Lissotes curvicornis* et m'a également été envoyé. Ce dernier porte les indications : "*Lissotes cancroides* Fab. Mount Wellington Tasmania, March 1866, ♂ and ♀"—"*L. curvicornis* Boisd. sec. type sp. Mus. Paris"—"W. Dr. Howitt. N.H."

La femelle existe également, avec les étiquettes : "♀. *cancroides*" "*L. curvicornis*" "W. Dr. Howitt. N.H."

Ces divers spécimens appartiennent sans aucun doute à la même espèce et sont des *L. curvicornis* Boisduval.

Lissotes subtuberculatus Westwood, Trans. Ent. Soc. Lond., 1855, p. 215, pl. 12, fig. 2. Le couple de cette espèce, possédé par le musée d'Oxford, peut être considéré comme typique, mais le type véritable se trouvait unique dans la collection Chevrolat. Ces spécimens ont exactement les mêmes indications de provenance que les deux *Lissotes curvicornis* mentionnés ci-dessus. Ces insectes

* Notes on the Genus *Lissotes*, with descriptions of New Species, by Arthur M. Lea, F.E.S., Government Entomologist. Proc. Royal Soc., Tasmania, 1910, pp. 346–366, pl. viii, ix.

sont d'ailleurs très étroitement apparentés et M. A. M. Lea, dans son travail, considère *L. subtuberculatus* comme une simple variété de *L. curvicornis.*

Oonotus adspersus Boheman, Ins. Caffr., ii., 1848, p. 384. La femelle, décrite par Westwood (Trans. Ent. Soc. Lond., 1863, p. 455, pl. 16, fig. 6) est conservée au British Museum, A défaut des exemplaires décrits par Boheman, on peut la considérer comme type. Avec cette femelle sont une autre femelle et un mâle, tous trois ayant fait partie de la collection Parry. Le mâle a la tête sensiblement plus large et les canthus plus développés; il est un peu plus grand et plus large.

Nigidius cribricollis Parry, Trans. Ent. Soc. Lond., 1873, p. 340, pl. 5, fig. 6, type. B. M.

Nigidius divergens Waterhouse, Ann. Mag. Nat. Hist., 1890, p. 38. Forte espèce, de la taille du *N. beningseni* Kraatz, aisément reconnaissable à la fossette longitudinale du pronotum et à quatre impressions bien marquées le long du bord antérieur incliné. Type. B. M.

Nigidius welwitschi Waterhouse, Ann. Mag. Nat. Hist., 1890, p. 39, type. B. M.

Nigidius distinctus Parry, Trans. Ent. Soc. Lond., 1873, p. 341, pl. 5, fig. 7, type. B. M.

Nigidius formosanus Bates, Proc. Zool. Soc. Lond., 1866, p. 347 type. B. M.

Nigidius obesus Parry, Trans. Ent. Soc. Lond., 1864, p. 63 type. B. M.

Nigiduis parryi Bates, Proc. Zool. Soc. Lond., 1866, p. 347. Le type n'est probablement pas un spécimen de la plus grande taille. Il ne présente aucune différence valable avec le *N. gigas* du Tonkin, décrit par M. Möllenkamp. *N. parryi* a seulement la tête un peu plus plate sur la partie antérieure, avec deux très légères impressions qui ne se remarquent pas sur un *N. gigas* de même taille pris comme exemplaire de comparaison. *N. gigas* me paraît être, tout au plus, une sous-variété de *N. parryi.* B. M.

Nigidius integer Westwood. Ent. Mag., 1838, p. 265. Cet insecte est conservé à Oxford. La synonymie : = *bubalus* Swederus a été donnée par Parry (Cat. 1864, p. 98).

Nigidius forcipatus Westwood, Ent. Mag., 1838, p. 267. Le type est un petit exemplaire de *N. laevicollis* Westwood. Le bord antérieur du pronotum est entièrement dépourvu de tubercule médian et il n'y a aucune fossette sur le disque;

les canthus oculaires et la dent supérieure de la mandibule sont moyennement développés. L'absence de tubercule médian au pronotum et la forme des canthus indiquent que cet exemplaire doit être une femelle. U. O.

Nigidius laevicollis Westwood, Proc. Zool. Soc. Lond., 1835, p. 128. Le type, également conservé à Oxford, est un assez grand exemplaire, plus développé comme mandibules et canthus que le précédent et possédant un petit tubercule médian à la marge antérieure du pronotum. C'est très probablement un mâle.

Je me suis assuré, sur un bon nombre d'exemplaires de cette espèce, que les mâles avaient toujours un tubercule médian au milieu du bord antérieur du pronotum et que les femelles en étaient dépourvues. Le *N. taurus*, décrit par Jakowleff, dont la distinction du *N. laevicollis* est basée sur le développement des canthus et des mandibules et sur la présence de ce tubercule qui, suivant Jakowleff, manque au *N. laevicollis* (ce que nous venons de reconnaître inexact), me paraît être simplement le mâle de cette espèce; ce nom doit passer en synonymie.

Nigidius trilobus Westwood, Ent. Mag., 1838, p. 263. Le type est conservé au British Museum. Cet insecte est certainement un *Figulus*.

Nigidius grandis Hope, Ann. Mag. Nat. Hist., 1841, p. 302. Cat., p. 26.—Le type est indiqué de Sierra Leone. C'est un exemplaire de taille moyenne. Cette espèce varie un peu comme sculpture du pronotum, mais est toujours facile à reconnaître. U. O.

Figulus binodulus Waterhouse, Ent. Monthly Mag., 1872, p. 277, type. B. M.

Figulus punctatus Waterhouse, Ent. Monthly Mag., 1872, p. 278, type. B. M.

Figulus rossi Gahan, Monogr. Christmas Isl., 1900, p. 96, type. B. M.

Figulus regularis Westwood, Ann. Sc. Nat., 1834, p. 120. Le type, conservé à Oxford, est un grand exemplaire. L'espèce semble très commune; c'est à elle que se rapportent le plus grand nombre des exemplaires reçus d'Australie.

Figulus sulcicollis Hope, Cat., p. 26. Cette espèce est peu connue, elle est décrite de Port Essington et paraît être beaucoup plus rare dans les collections. Ayant pu comparer à loisir les deux types, je crois devoir indiquer quels sont les caractères qui permettent de les distinguer.

F. sulcicollis a la tête un peu plus anguleuse en avant; les canthus sont plutôt coudés que régulièrement arrondis, soit en avant, soit en arrière. Le milieu du disque céphalique est lisse chez cette espèce, il est ponctué, surtout au bord frontal, chez *F. regularis.*

Le prothorax a à peu près la même forme, mais est sensiblement plus long chez *sulcicollis.* Le milieu du disque porte une véritable fossette avec des points enfoncés au lieu d'une série de points enfoncés chez *regularis.* Les points s'avancent jusque près de la saillie anguleuse du bord antérieur chez *regularis*, ils en restent éloignés, comme le sillon lui-même, chez *sulcicollis.*

La ponctuation générale est plus fine chez ce dernier. Les élytres ne paraissent pas différer beaucoup, mais l'angle huméral est épineux chez *regularis* et seulement assez aigu chez *sulcicollis.*

Les mandibules de ce dernier sont plus fortes, plus horizontales, moins ponctuées sur le côté externe, celles de *regularis* sont vraiment relevées à l'extrémité.

Les tibias antérieurs sont plus larges, avec la fourche plus longue chez *regularis.*

Les deux types de *F. sulcicollis* sont conservés à Oxford. Les exemplaires qui se rapprochent le plus de ces spécimens, dans les collections modernes, sont des *Figulus* du Queensland, qui ont sensiblement même forme, mais sont bien plus fortement ponctués.

Figulus subcastaneus Westwood, Ent. Mag., 1838, p. 263. C'est une petite espèce qui, comme aspect général, ressemble beaucoup au *F. marginalis* Ritsema. Il s'agit, en réalité, d'une espèce voisine mais distincte. La tête porte une bosse centrale médiane entre les yeux et le prothorax est notablement plus court, à peu près aussi large que long, avec les angles postérieurs et antérieurs arrondis. La fossette du pronotum est linéaire, ponctuée à deux rangées; elle n'atteint pas la marge antérieure, qui n'est pas tuberculée au milieu, et rejoint au contraire la postérieure. Les élytres sont remarquablement longues, striées finement, les intervalles lisses et presque plats, les stries régulièrement ponctuées. U. O.

Figulus manillarum Hope, Cat., p. 26. Le type est conservé au musée d'Oxford.

Figulus ebenus Westwood, Ann. Sc. Nat., 1834, p. 120, pl. 7, fig. 4. Le type est un grand exemplaire de Madagascar, dont les stries latérales des élytres sont bien marquées.

C'est une des formes locales du *F. sublaevis* qui est assez variable comme sculpture des élytres. U. O.

Figulus nigritus Westwood, Ent. Mag., 1838, p. 161. Le type est un exemplaire du Sénégal, plus petit que le précédent; les stries latérales des élytres sont un peu moins prononcées. C'est une autre forme du *F. sublaevis*. U. O.

Cardanus sulcatus Westwood, Ann. Sc. Nat., 1834, p. 113, pl. 7, fig. 1. Le type, conservé à Oxford, est un exemplaire de grande taille.

Cardanus cribratus Parry, Trans. Ent. Soc. Lond., 1870, p. 98. Le type, conservé au British Museum, ressemble à un *C. sulcatus* de grandeur réduite à moitié. C'est un insecte d'un noir terne dont le prothorax a une forme plus simple que celle du *C. sulcatus*. La fovéole médiane est grande, peu profonde, à bords assez larges, formant fer à cheval ouvert en arrière. La dent des mandibules est très faible.

Hexaphyllum westwoodi Hope, Proc. Ent. Soc. Lond., 1840, p. 11. Le mâle et la femelle de Nouvelle Grenade, qui sont les types de Hope, sont conservés à Oxford. La synonymie de cette espèce et de *H. aequinoctiale* Buquet a été indiquée par Burmeister (Handb. v, p. 332).

H. aequinoctiale n'est pas une espèce répandue dans les collections, on peut la considérer comme rare. Les spécimens d'Oxford se distinguent de *H. schuberti* Perty par le pronotum entièrement ponctué, moins bombé, avec une dépression longitudinale médiane moins marquée; par les nervures élytrales étroites et ponctuées, et surtout par la forme des mandibules dont la dent latérale interne est beaucoup plus forte et la deuxième dent supérieure, à partir de la base, bien plus voisine de l'extrémité apicale.

Hexaphyllum brasiliense Gray in Griff. Anim. Kingd., Ins. i, 1832, p. 536, pl. 46, fig. 4. Un mâle et deux femelles, indiqués comme types de "*H. brasiliense* Gray = *Psilodon schuberti* Perty" sont conservés à Oxford. Ce sont trois exemplaires de grandes dimensions de l'espèce que l'on trouve habituellement dans les collections.

Aesalus neotropicalis Bates, Biol. Cent.-Amer., Col. ii, 1886, p. 2, pl. 1, figs 3, 3*a*. Plusieurs exemplaires types, provenance: "Guatemala City." B. M.

Aesalus smithi Bates, Biol. Cent.-Amer., Col. ii, 1886, p. 382. Un seul exemplaire type, provenance: "Chilpancingo, Guerrero, 4,000 ft., June. B. M.

Mitophyllus marmoratus Waterhouse, Ent. Monthly Mag., 1874, p. 8. Le type du British Museum porte

l'annotation " Specimen of *M. marmoratus* sent to Oberthür agrees with type of *M. parryanus* sec. Oberthür," d'après laquelle cette espèce devrait passer en synonymie.

Ceratognathus rufipennis Westwood, Trans. Ent. Soc. Lond., p. 82 pl. 2, fig. 2. Le type est conservé au British Museum. La figure donnée par Westwood n'est pas très bonne.

Ceratognathus niger Westwood, Ent. Mag., 1838, p. 261, fig. Le type, conservé à Oxford, est un fort mâle. Les pièces de la bouche ont été disséquées et conservées avec l'insecte.

Ceratognathus abdominalis, Parry, Trans. Ent. Soc. Lond., 1870, p. 99. La description de cet insecte paraît le rapprocher de *C. froggatti* Blackburn. En réalité, le type, qui existe au British Museum, appartient à une petite espèce bien distincte.

Ceratognathus areolatus Westwood, Trans. Ent. Soc. Lond. 1863, p. 430, pl. 14. fig. 2. L'exemplaire femelle, conservé à Oxford, qui sert de type à cette espece, a été rapporté par Parry au *C. helotoides* Thomson. Le *C. helotoides* étant de Nouvelle Zélande et la *C. areolatus* étant, d'après ses étiquettes de provenance, de Nouvelle Hollande, bien que décrit de Nouvelle Zélande, il était intéressant de vérifier la synonymie proposée, d'autant plus qu'il existe, en Australie, une espèce assez voisine comme aspect du *C. helotoides*, le *C. gilesi* Blackburn. Après un examen attentif il n'y a pas de doute pour moi que *C. areolatus* est bien la femelle de *C. helotoides*. Il reste à expliquer pourquoi l'insecte porte une étiquette " W. Dr. Howitt N.H.," celle-ci a probablement été mise par erreur à la réception de ce spécimen, car *C. helotoides* n'a pas, jusqu'ici, été signalé d'Australie.

Types ou spécimens typiques appartenant au British Museum et au Musée de l'Université d'Oxford étudiés ou cités dans la note précédente.

Nota.—Les noms des espèces non-valables sont indiqués en italique. Les espèces pour lesquelles une modification est proposée dans la nomenclature sont indiquées par un astérisque.

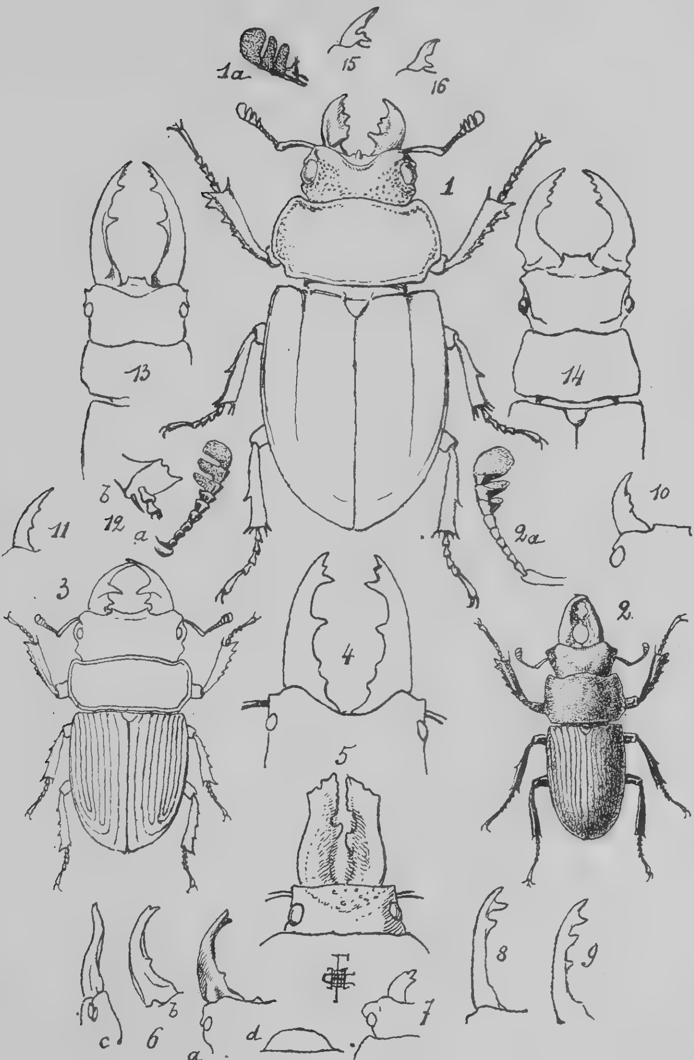
Explanation of Plate IX.

[*See Explanation facing the* Plate.]

[Légende de la Planche.]

Explanation of Plate IX.

Fig. 1. *Pseudodorcus hydrophiloides* Hope, ♂. 1*a*. antenne.
2. *Charagmophorus lineatus* Waterhouse, ♂. 2*a*. antenne.
3. *Alcimus dilatatus* Fairmaire, ♂.
4. *Leptinopterus melanarius* Hope, ♂, mandibules.
5. *Lamprima latreillei* var. *coerulea* Donovan, ♂, mandibules.
6. *Prosopocoelus spencei* Hope, ♂, mandibules vues par dessus (*a*), par dessous (*b*), de côté (*c*); menton (*d*).
7. *Oonotus adspersus* Boheman, ♂, tête.
8. *Prosopocoelus quadridens* Hope, ♂, mandibule.
9. *Prosopocoelus sayersi* Hope, ♂, mandibule.
10. *Eurytrachelus submolaris* Hope, ♂, mandibule.
11. *Eurytrachelus punctilabris* Hope, ♂, mandibule.
12. *Aulacostethus archeri* Waterhouse, ♂, *a*. antenne, *b*. extrémité du tibia postérieur.
13. *Psalidoremus motschulskyi* Waterhouse, ♂.
14. *Lucanus* sp. ? = *ibericus* Motschulsky nec *Akbesiana* Planet.
15. *Aegus parryi* Waterhouse, ♂, type, mandibule.
16. *Aegus parryi* Waterhouse, ♂ = *Ae. westwoodi*, Boileau.



C. Hentschel.

DETAILS OF LUCANIDAE

Reprinted from "The Entomologist's Monthly Magazine," 3rd Series, Vol. iii.

NOTES ON THE *COLEOPTERA* RECORDED FROM "RESIN ANIMÉ" BY THE REV. F. W. HOPE.

BY G. C. CHAMPION, F.Z.S.

In the Magazin de Zoologie, 1842, pls. 87–89, the Rev. F. W. Hope described and figured three beetles found in "Resin Animé," no localities being given for any of them, nor any particulars as to the source of the resin itself, except the statement that one of the insects, *Monomma resinorum*, was perhaps from Mauritius—*Hab.: Forsitan in "Insula Cernensi."* A whole coloured plate was given for each beetle, all drawn by Westwood, and details of structure added. These *Coleoptera* have never been identified with existing forms, and are, in fact, omitted from the Munich Catalogue. A special search for them, or rather for the pieces of resin in which they are contained, has recently been made in the University Museum at Oxford, at my request, but only one [*Calcar* (?) *inhumatus*] can be found. The genus of this latter can now be definitely stated, and some remarks on the three insects may be of interest.

1.—*Monomma resinorum*, pl. 87. There can be no doubt as to the correct determination of this genus, *Hyporrhagus* being confined to America. The unusually large, shallow, seriately-arranged foveae on the dorsal surface of the elytra, if not unduly magnified, as seen through the medium in which the insect is immersed, should render the identification of the species possible. Numerous very similar forms are found in Madagascar, S. Africa, the Philippines, Seychelles, etc.; but I have not come across one with the elytral foveae so large at the base. The structural details given by Westwood on this plate, as noted by him in pencil in a copy of the paper in the Hope library, were taken from other specimens in the Museum, one of which is there ticketed "Mad." (= Madagascar).

2.—*Megalocera rubricollis*, pl. 88. Hope did not mention the family to which this insect was to be referred, though a new generic name was used for it. To judge from the figures, *M. rubricollis* looks like an Oedemerid, but the very strongly serrate antennae resemble those of some of the Lagriids, among which Lacordaire placed the genus. The elytra are shown as strongly striato-punctate; the prothorax oblong-cordate, with acute, outwardly-directed hind angles; the intermediate tarsi 5-jointed (6 joints are clearly shown in the main coloured figure), and the posterior tarsi 4-jointed, both with broadly lobed penultimate joint; the apical joint of the maxillary palpi oblong-ovate, with

truncated apex. In the Fry collection at the British Museum, a Brazilian Lagriid, identified by him as *Lagria collaris* Olivier, an insect roughly figured by that author, and no locality given, is placed under the generic name *Megalocera*; but it cannot be congeneric with Hope's species, and the identification with that of Olivier is incorrect.

3.—*Calcar* (?) *inhumatus*, pl. 89. There are two specimens of this insect preserved in one piece of resin, placed on the same line, whether viewed vertically or horizontally. One of them is in perfect condition, and shows, when examined at a particular angle, the stout triangular tooth at the apex of the anterior femur beneath, a character overlooked by both Hope and Westwood. This structure, combined with the form of the head, at once indicates the genus *Gonocnemis* Thomson (1858), which is placed by Lacordaire in his section "Megacanthides" of the *Tenebrionidae*, numerous in species in Tropical Africa, east and west. It is not improbable that *C. inhumatus* could be identified amongst the material in the British Museum or elsewhere, if removed from the resin and cleaned.

From a study of these three beetles, it can be safely assumed that they are all E. African. "Resin Animé" is a recently-formed product, akin to gum copal, and the insects found in it may be referable to existing forms.

Horsell, Woking:
December 11*th*, 1916.

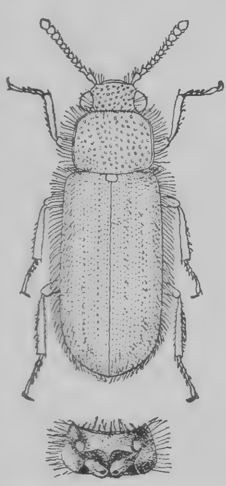
[The name "Gum Animé" was originally applied to the resin of the Tropical American tree, *Hymenaea courbaril* (Nat. Order *Leguminosae*), and has been transferred to the product of the allied African *Trachylobium hornemannianum*. The latter resin is better known under the title of "Copal," as a basis for the finest kinds of varnish, and the most esteemed quality comes from East Africa, where it is found in a sub-fossil state over a large extent of country, the recent resin being of comparatively little value. At Zanzibar and other ports on this coast, pieces of "Copal" enclosing *Coleoptera* and other insects, often in a beautiful state of preservation, are commonly sold as "curios." The resin in which the Hope specimens are contained appears on examination to be true African "copal."—J. J. W.]

[*Reprinted from the 'Entomologist's Monthly Magazine,'* 3rd ser., vol. viii.]

THE GEOGRAPHICAL DISTRIBUTION AND SYNONYMY OF THE DASYTID-BEETLE *ACANTHOCNEMUS NIGRICANS* HOPE (=*CILIATUS* PERRIS).

BY G. C. CHAMPION, F.Z.S.

Bourgeois (Bull. Soc. Ent. Fr. 1904, pp. 25, 26), in a paper entitled "Sur le cosmopolitisme de l'*Acanthocnemus ciliatus* Perris, Coléoptère de la tribu des Dasytides," gives a detailed account of the extraordinary distribution of this beetle and of its formidable synonymy. The species, he says, has been described under six different names, and referred to three different genera. Nevertheless, two specific names have still to be added, *nigricans* and *fuscipennis* Hope, one of which, *nigricans*, must replace that of *ciliatus* Perris, it having 21 years' priority. The types of Hope's insects, both of which were referred by him to the genus *Dasytes*, and both from Adelaide, S. Australia, have been lent me by Prof. Poulton, and they agree perfectly with an example of *Acanthocnemus ciliatus* from Erbalunga, Corsica, kindly communicated by Lt.-Col. J. St. Claire Deville. Mr. A. M. Lea, in re-describing these Australian insects in 1909, is the only author who has noticed one of the most important characters of the genus, viz. the presence of very deep, almost circular foveae (these having a silvery appearance in certain lights) on the propleura, about which the French and German writers say nothing, their diagnoses having doubtless been drawn up from carded specimens. *A. nigricans* has the general appearance of a Trogositid or Cryptophagid, and the hairy body and ciliate elytral margins of certain Dasytids, amongst which the genus seems best placed.* The insect has been described by Lea, as well as by other authors, and it is only necessary to say that it is of a flattened, subcylindrical shape, blackish or fuscous in colour, with the antennae and legs more or less ferruginous; the numerous specimens before me measure from 4–5¼ mm. in length and 1½–2 mm. in width. The characters of the genus given below were taken from Australian and Rhodesian examples before the descriptions



Acanthocnemus nigricans Hope, ♂, × 9, the long hairs on the dorsal surface omitted; the lower figure shows the prosternal foveae.

* The genus *Antixoon* Gorh. (1886), type *A. cribripenne*, from Panama, described as a Melyrid, is a Trogositid allied to *Diontolobus* Solier.

of the Continental authors had been seen by me, or the identity of their insects with Hope's species had been suspected. This definition adds a few particulars regarding the structure of the mouth-parts, tarsi, prosternum, etc. In the short basal joint of the tarsi and the flattened subcylindrical body, *Acanthocnemus* approaches *Pelecophorus* Latr., which includes two or three species from Mauritius and Réunion; but it differs from that genus in the structure of the palpi, antennae, tibiae, and tarsal claws, the bristly vestiture, and the deeply foveate prosternum. The specimens assumed to be ♂ have four visible joints only to the anterior tarsi, a character common to several genera of Malachiids.

The revised synonymy and generic definition will stand thus:—

Acanthocnemus.

Acanthocnemus Perris, Ann. Soc. Ent. Fr. 1866, p. 187; Bourgeois, Bull. Soc. Ent. Fr. 1904, p. 26; Reitter, Faun. Germ., Käfer, iii, p. 283 (1911).

Eurema Abeille de Perrin, L'Echange, x, p. 93 (1894); Bull. Soc. Ent. Fr. 1896, p. 261.

Hovacnemus Fairmaire, Ann. Soc. Ent. Belg. xlii, p. 232 (1898).

Dasytes (Paykull), Sect. 1, Lea, Trans. Ent. Soc. Lond. 1909, p. 239.

Head transverse, broad, the epistoma short, confused with the front; labrum short; eyes large, entire; mandibles stout, dentate before the middle within, feebly emarginate at the tip; terminal joint of the maxillary and labial palpi narrow, subcylindrical, truncate at apex, the penultimate joint short; antennae 11-jointed, stout, joint 1 very stout, 2–11 perfoliate, 2 and 3 obconic, 4–8 submoniliform, transverse, 9–11 much stouter than those preceding, together forming a loose club; prothorax transverse, sharply margined at sides and base; scutellum strongly transverse; elytra long, flattened, subparallel, with numerous rows of punctures, the epipleura reaching as far as the apex of the metasternum; prosternum with a deep, almost circular, flat-bottomed fovea on each flank exterior to the sinuous transverse ridge closing the anterior coxal cavities in front, the cavities themselves widely open behind, and the coxae contiguous; five ventral segments exposed; tibiae asperate, subdenticulate on their outer edge, the spurs short; tarsi simple, 5-jointed, 1 short, wanting or fused with 2 on anterior pair in ♂, 5 long, the claws long, simple; body subcylindrical, hairy, the hairs forming a close fringe along the elytral margins, the antennae and tibiae setose.

Type, *Dasytes nigricans* Hope (= *Acanthocnemus ciliatus* Perris).

Acanthocnemus nigricans.

Dasytes nigricans Hope, Trans. Ent. Soc. Lond. 1845, p. 105[1]; Lea, *op. cit.* 1909, p. 243[2].

Dasytes fuscipennis Hope, *loc. cit.*[3]; Lea, *op. cit.* p. 241[4].

Acanthocnemus ciliatus Perris, Ann. Soc. Ent. Fr. 1866, p. 188[5]; Schilsky, in Küster's Käf. Europas, xxxi, no. 16 (1895)[6]; Bourg., Bull. Soc. Ent. Fr. 1904, pp. 25, 26[7].

Acanthocnemus truquii Baudi, Berl. ent. Zeitschr. 1873, p. 321[8].
Acanthocnemus fauveli Bourg. Rev. d'Ent. 1884, p. 289[9].

Eürema dilutum Abeille de Perrin, L'Echange, x, p. 93 (1894)[10]; Bull. Soc. Ent. Fr. 1896, p. 261[11].

Acanthocnemus kraatzi Schilsky, Deutsche ent. Zeitschr. 1896, p. 361[12].

Hovacnemus pallitarsis Fairm. Ann. Soc. Ent. Belg. xlii, p. 232 (1898)[13].

Hab. AUSTRALIA[7]; S. AUSTRALIA, Adelaide[1–4] (*Fortnum: types in Mus. Oxon.*; *Mus. Brit.*); W. AUSTRALIA[4]; NEW SOUTH WALES[4]; QUEENSLAND[4]; TASMANIA[4]; NEW CALEDONIA[9]; SIAM (*Vitalis de Salvaza*: iv.1920); BURMA (*coll. H. E. Andrewes*); INDIA, Tenasserim[7] (*Fea*: 1887); MADAGASCAR[13]; S. and N.W. RHODESIA, various localities (*Dr. Marshall, H. C. Dollman*: 1901–1915); GUINEA[12]; ALGERIA[10]; CORSICA[5 6]; SARDINIA[11]; CYPRUS[8].

According to Mr. Lea[4], this is probably the most widely distributed Malacoderm beetle in Australia, occurring under the bark of *Eucalyptus*-trees, and also coming to light at night. It would therefore appear that Australia is the real home of *A. nigricans*, Fortnum having captured specimens at Adelaide as long ago as 1841. The next record, 1866, is that of an example found by Revelière under the bark of a juniper in Corsica. Presumably the insect has been transported by commerce, either in the larval or imaginal condition, in cereals, etc., like *Plochionus pallens*, *Tenebroides mauritanicus*, *Silvanus surinamensis*, *Platycotylus inusitatus*, etc., and has now become cosmopolitan throughout the warmer parts of the Old World. The present writer has recorded * the capture of living examples of an Argentine Dasytid, *Astylus atromaculatus* Blanch., at Durban and Pretoria, which were probably brought there in hay during the Boer War.

Horsell.
March 1922.

---

* Ann. Mag. Nat. Hist. (9) ii, p. 352 (Oct. 1918).

From the Annals and Magazine of Natural History,
Ser. 8, Vol. xvii., *May* 1916.

A new Genus of Anthicidæ (*Coleoptera*) *from the Islands of Mysol and Waigiou.* By G. C. Champion, F.Z.S.

Mr. Blair having called attention to the systematic position of the Australian genera *Lemodes*, *Lemodinus*, and *Trichananca* [Ann. & Mag. Nat. Hist. (8) xi. pp. 207–209 (1913)], it is advisable to describe an allied genus found by the late A. R. Wallace in the above-mentioned Malayan islands. Specimens of this insect were acquired by Westwood for the Hope Museum more than fifty years ago, and others have also been detected amongst the Lagriids in the British Museum.

Lagriomorpha, gen. nov.

Head short, subtriangular, broadly truncated above the moderately wide neck, the eyes small, rounded, prominent, inserted at a little before the base, the epistoma transverse, depressed, confused with the front, and somewhat prominent, the antennæ stout, rapidly widened outwards, inserted beneath a tuberculiform prominence at some distance from the eyes; labrum short; mandibles short, broad, feebly bidentate at tip; mentum strongly transverse, supported by a broad gular process; maxillary palpi stout, joint 4 strongly securiform; terminal joint of labial palpi stout, ovate, obliquely subtruncate at tip; prothorax subcampanulate, convex, immarginate laterally and at base, about as wide as the head; scutellum transversely quadrate; elytra long, confusedly punctate, the inflexed portion almost covering the metathoracic episterna, the epipleura narrow, incomplete; prosternum separated from the propleura by an oblique suture; anterior coxal cavities widely open behind the large, conical, contiguous coxæ; mesosternum long, very narrowly separating the middle coxæ; ventral segment 1 as long as the metasternum, 2–5 comparatively short, subequal; posterior coxæ rather large, well separated; legs moderately stout; tibiæ finely carinate towards their outer edge, above and beneath, the spurs minute and scarcely visible; tarsi with their penultimate joint narrow, deeply excavate above for the reception of the terminal joint, the claws simple.

Type, *L. semicærulea*.

The Malayan insect forming the type of this genus would perhaps be mistaken at first sight for a Lagriid; but the

widely open anterior coxal cavities and other characters bring it near *Lemodes*, Boh., and *Trichananca*, Blackb., recently referred by Blair to the Anthicidæ. The carinate tibiæ and the greatly widened outer joints of the antennæ separate *Lagriomorpha* from both these genera, the general facies, too, being very different.

Lagriomorpha semicærulea, sp. n.

Elongate, depressed, a little widened posteriorly, especially in ♂, subopaque, the elytra and under surface shining, finely pubescent; ochraceous or rufo-testaceous, the elytra with about the apical two-thirds metallic blue, the antennal joints from 4–6 onward (the rufescent tip of 11 excepted) black and densely pubescent, the posterior legs with the knees, tibiæ, and first tarsal joint (and in one specimen the corresponding portions of the intermediate legs also) sometimes more or less infuscate, the abdomen in great part piceous. Head closely, shallowly punctate; antennæ moderately long, joint 3 slightly longer than 2, 4–11 more elongate, becoming rapidly wider, 8–10 very broad, triangular, 11 acuminate-ovate, much longer than 10, constricted at the middle; joint 4 of maxillary palpi broader in ♂ than in ♀. Prothorax about as long as broad, rounded at the sides, obliquely constricted before the base, closely, shallowly punctate, the interspaces alutaceous. Elytra broader than the prothorax, more elongate in ♀ than in ♂, slightly depressed below the base, closely, rather coarsely, confusedly punctate. Beneath closely, minutely punctate, with scattered larger punctures intermixed.

Length $5\frac{1}{2}$–8, breadth $1\frac{1}{2}$–$2\frac{1}{4}$ mm. (♂ ♀).

Hab. MYSOL and WAIGIOU (*A. R. Wallace*).

Described from four females and two males, two of the former, from Mysol, belonging to the British Museum (*ex coll. Pascoe*), the others purchased by the Oxford Museum in 1862 or 1863, one only of them (a ♂) being from Waigiou. The males (one from each island) are smaller and less elongate than the females, and both of them have an indication of a faint, transverse or curved, pallid fascia on the disc of each elytron at about one-third or one-fourth from the apex.

[*Reprinted from the 'Entomologist's Monthly Magazine,'* 3rd ser., vol. viii.]

NOTES ON SOME AUSTRALIAN ANTS.

BIOLOGICAL NOTES BY E. B. POULTON, D.SC., M.A., F.R.S.,
AND NOTES AND DESCRIPTIONS OF NEW FORMS BY
W. C. CRAWLEY, B.A., F.E.S., F.R.M.S.

The following paper contains an account of some ants collected during 1914 in West Australia, South Australia, Victoria, and New South Wales. The notes on the habits of each species were made at the time of capture, and Professor Poulton has added further observations from memory. These are indicated by quotation marks and the initials "E. B. P." All captures without the addition of any name or initials were made by Professor Poulton, who contributes the following general notes :—

"During my brief visit to Australia—July 29th to August 27th, 1914, with a few hours at Fremantle on August 31st—I was much struck with the dominant position of the ants in the insect fauna. Other insects were scarce, especially the Lepidoptera; indeed the only day on which I saw an abundance of varied insect life was August 31st, at Cottesloe Beach, Fremantle, where the 'wattle' (*Acacia* spp.) was in bloom and attractive to many species. The important position taken by the ants is shown by the species recorded in the present paper, although allowance must be made for the fact that ants are more easily found in a time of scarcity than most insects. But I do not doubt that their predominance in Australia is real.

"I noticed when collecting *Camponotus nigriceps* race *dimidiata* (*infra* p. 125) under the bark of a prostrate tree-trunk near Healesville, Victoria, that Hemiptera on the bark of an adjacent tree were ant-like in appearance and especially in their movements; also at the same time small Coleoptera under and in rotten logs and on bark were, when running, very ant-like. Mr. R. E. Turner has recorded a unique feature in the mimicry, by a fossorial wasp, *Aphelostoma tasmanica* Westw., of the

formidable 'Bull-dog' ants of the genus *Myrmecia*. When alarmed, the wasp often picks up a fragment of dead stick or leaf, which it carries in its mandibles, thus increasing the resemblance to an ant (Proc. Ent. Soc. Lond. 1919, p. xxxvii). I anticipate that the mimicry of ants will prove to be a special feature of the Australian fauna.

"In making the collection here described I received the kindest help from Mr. L. le Seouef, Director of the Zoological Gardens, Perth, and from Mr. H. M. Giles, the Head Keeper; and at and near Healesville from Mr. R. Kelly. A few of the ants were collected in the Blue Mountains, N.S.W., by Prof. von Luschan, of Berlin."

Sub-family I. *Ponerinae* Lep.

Myrmecia vindex Sm.—☿. From many adjacent nests of various sizes. S. Perth, Swan River bank near Zoological Gardens, 2.viii.14 (*L. le Seouef*; *E. B. P.*).

"This species is one of the well-known 'Bull-dog' ants of Australia, a term no doubt applied to many others in the genus. The number of nests in a small area seemed to be a definite habit and is probably advantageous on the Müllerian principle. An enemy having experienced the defensive powers at the mouth of one nest would carefully avoid disturbing others. Thus each nest would help in guarding the rest. The behaviour of the ants was different from any I have seen. Around and just inside the entrance, which appeared to descend vertically into the earth, was a little group of ants. The head of each ant was always facing outwards in the direction of possible attack. When disturbed, the ants walked slowly, with widely opened mandibles, towards the enemy. I have never seen suggested, in the bearing of an insect, so firm a confidence in the possession of terrible powers of defence and such relentless determination to use them. The result was to make them particularly easy to capture with the forceps; for retreat of any kind or the avoidance of danger by rapid movement was quite foreign to their nature."—E. B. P.

Some species of ants, by a system of colonisation in addition to the general mode of founding nests by means of fertilised females, succeed in establishing enormous colonies consisting of scores or even hundreds of separate nests, all the members of the different nests being on friendly terms with each other. This is the case with the common European *Formica rufa* and others, and it is possible that some species of *Myrmecia* have a similar habit. It would be interesting to ascertain

whether the members of the different nests of *M. vindex* referred to above were friendly to each other.

M. forficata F.—4 ☿ ☿. Under log in bush, Victoria, near Healesville, Narbethong, Springbank. One ☿ has a ☿ of *Camponotus ferruginipes*, sp. n., fixed to its leg. "When the two were captured and put in the same box, the *Camponotus* seized the leg of the Ponerine. When the box was opened a few hours later the *Camponotus* was dead but still holding on tightly to the living *Myrmecia*."—E. B. P.

One deälated ♀ was taken under a log in the same locality (*R. Kelly*), and 3 ♀ under a stone near Black Spur in the same district (*E. B. P.*), 15.viii.14.

Amblyopone ferruginea Sm.—8 ☿ ☿. From nest under stone, Blue Mts., N.S.W., near Mt. Victoria, 23.viii.14.

A. australis Erichs.—2 ☿ ☿. Victoria, Healesville to Narbethong, Maryville road, 15.viii.14.

Euponera (*Brachyponera*) *lutea* Mayr.—☿ ♂. Near Perth, Yallingup to Mammoth and Lake Caves, under log or stone in bush, 31.vii.14.

☿ ☿, 5 ♂ ♂, and one alate ♀ were taken by H. M. Giles at Mundaring Weir, near Perth, 3.viii.14, and a single deälate ♀, taken at an earlier date by the same collector, bears the note "Probably Perth District." ♂ ♂ and ♀ ♀ of this very abundant species are often taken after the marriage flight without ☿ ☿, and it was probably from such a ♂ and ♀ that Mayr described the sexes of his species, as he says "*Probably* belonging to this species." Up to recent years I had never received either ♂ ♂ or ♀ ♀ taken with the ☿ ☿, and therefore when Prof. Poulton showed me some ☿ ☿ and one deälate ♀ (queen) taken together under a stone close to the platform at Picton Junction, near Perth, 1.viii.14, the ♀ differing entirely from Mayr's ♀, it occurred to me that this ♀ was the true female of *E. lutea*. I described this ant in 1918 (Ent. Rec. xxx. 5, p. 86) as the true ♀ of this species, or alternatively a "B" form. There is no doubt, however, that the ♀ described by Mayr is the typical ♀ of *lutea*, and therefore the very interesting one discovered by Prof. Poulton must be considered as a "B" form. It is just possible that it may be a parasitic ♀ of another species, though this is not so probable from its appearance. I have recently received many ♂ ♂ and ♀ ♀ taken in nests with ☿ ☿ from different parts of Australia, all the ♀ ♀ being the typical forms. It is a very variable ant as regards colour, ranging from pale yellow to almost black in the same colony, and numerous myrmecophiles are found in its populous nests. The figures

show the great difference in size and structure in the two forms of ♀. In profile the scale of the "B" ♀ is thick like that of the ☿, not knife-edged as in the normal ♀.

Rhytidoponera (*Chalcoponera*) *metallica* Sm.—☿. One under log, Mundaring Weir, 3.viii.14; one ☿, Mundaring Weir, 3.viii.14 (*H. M. Giles*); and 6 under stone, Adelaide, Mt. Lofty Range, 10.viii.14.

The specimens from the latter locality are all uniform dark metallic green, and the coarse longitudinal striae on the front do not continue so

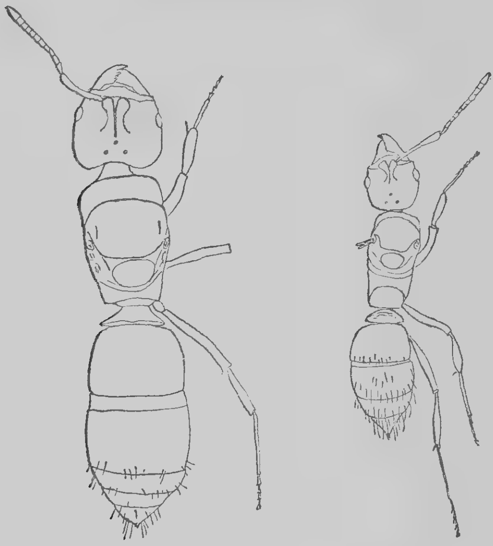


Fig. 1.—Normal ♀ of *Euponera lutea* Mayr. (On same scale as fig. 2.)

Fig. 2.—"B" ♀ of *Euponera lutea* Mayr. (On same scale as fig. 1.)

far as in typical specimens; the scale is straight, not concave, behind; the first segment of gaster has shallow punctures among the fine striae, and the second segment has fewer and shallower ones. The anterior border of the clypeus has a somewhat more pointed form, and the head is not quite so emarginate behind as in typical forms.

This very abundant ant varies greatly, and a number of varieties in addition to those already described might readily be named, but in all probability many of these slight variations are found in the same colony, especially the colour variations. The metallic sheen ranges in all shades from red and purple to green and blue.

R. (*C.*) *metallica* Sm., var. *tasmaniensis* Emery.—5 ☿. Near Perth, Yallingup to Mammoth and Lake Caves, under log or stone in bush, 31.vii.14.

R. (*C.*) *metallica* Sm., var. *cristulata* Forel.—♂ ☿. Blue Mts., N.S.W., near Mt. Victoria. Nest under stone, 23.viii.14.

For description of the ♂, which was taken on this occasion for the first time, see Ent. Rec. xxx. 5, p. 88 (1918).

R. (*C.*) *victoriae* André.—2 ♂, 6 ☿. Victoria, near Healesville, Narbethong, Springbank. Nest under log in bush, 15.viii.14.

♂ (hitherto undescribed). Length 4·8 mm. Black; tip of gaster, articulations of legs and terminal joints of tarsi, ferruginous, also mesonotum; antennae dark brown. Wings pale brown and iridescent, nervures dark brown.

Head broader than long, narrowing in front and behind. Mandibles with 7-8 teeth. Clypeus bulbous, depressed along anterior border, which is feebly convex. Frontal area triangular, slightly impressed. Eyes large and oblong, placed obliquely across the side of head in front of middle, occupying a little more than ½ the side. Scapes short, about twice as long as broad, nearly twice as long as 1st segment of funiculus which is about as broad as long; 2nd joint long, longer than the scape and 1st joint together, the rest diminishing in length and increasing in breadth to the apical, which is about as long as the 2nd. All except 1st much longer than broad. The whole antenna ¾ as long as the whole insect.

Scutellum prominent, a transverse impression dividing it from the scutum. Base of epinotum equals the declivity, the latter plane, sub-bordered. Scale from above longer than broad, the sides concave in front, the concavity forming a ridge which ends in a blunt tooth at each side. Underneath is a flat lamella ending in a blunt tooth directed forwards; in the centre of the lamella is a circular translucent aperture.

Pilosity: body sparsely provided with erect brown hairs; pubescence nil except on antennae. Tibiae with erect hairs.

Gaster and mandibles shining, the rest sub-matt. Mandibles with very few small punctures; rest of head roughened, mostly longitudinally. Scutum anteriorly with a short longitudinal impression from which radiate fine striae. Mayrian furrows with broad transverse grooves, shining, the rest and the scutellum irregularly and longitudinally rugose-striate. Epinotum irregularly and coarsely transversely reticulate. Node with irregular lines. Gaster shining and smooth, with traces here and there of superficial striae.

Sub-family III. *Myrmicinae* Lep.

Aphaenogaster (*Nystalomyrma*) *longiceps* Sm.—13 ☿ ☿, near Healesville, Victoria, under rotting log, 16.viii.14. These ☿ ☿ agree perfectly with Smith's type.

A. (*N.*) *poultoni* Crawley.—Three ☿ ☿, taken by Prof. Poulton in the Zoological Gardens, Perth. I have received numbers of this species from the neighbourhood of Perth.

"I have no special recollection of the nest of *longiceps*, but I feel sure that the log when raised only disclosed a series of tunnels from which the ants were taken. The openings to the nests of *poultoni* in the Zoological Gardens were very characteristic. They were scattered sparingly over the bare turf and were all alike, being deep, circular, little craters, from memory about 1½ inches in diameter, with a small central hole passing vertically downward. The crater was surrounded by a wall of pure yellow sand evidently brought up from below the superficial soil, from which it was entirely free. The yellow sand also lined the crater, which, with its wall, was a very conspicuous object. Very few ants were seen in the craters, never more than one or, at the most, two in each."—E. B. P.

A. poultoni is described in a paper now being printed for the Ann. and Mag. Nat. Hist.

Pheidole variabilis Mayr var.—A single ♃ under stone, Blue Mts., N.S.W., near Mt. Victoria, 23.viii.14. This appears to be one of the numerous varieties of this species. It is very like var. *rugocciput* For. from Queensland, as it has the whole head longitudinally striate and reticulate between the striae, but the scapes are somewhat shorter than in *rugocciput*.

Monomorium (*Mitara*) *ilia* For.— ☿ ☿ and 4 ♀ ♀, from nests in rotten wood, S. Perth, Zoological Gardens, and Swan River Bank, 2.viii.14 (*L. le Seouef*; *H. M. Giles*; *E. B. P.*).

Crematogaster australis Mayr.— ☿ ☿, many ♂ ♂, 3 alate and one dëalate ♀, S. Perth, Swan River bank, near Zoological Gardens. From 3 nests in rotten *Melaleuca* trunk, 2.viii.14 (*L. le Seouef; E. B. P.*). "The nests, of which two were found on one tree, were excessively populous."—E. B. P.

This I take to be Mayr's species from his description, though I have never seen a co-type or a specimen named by a myrmecologist who has seen the type, and I am not completely satisfied that this is *australis*.

C. rufotestacea Mayr.—5 ☿ ☿, under log or stone in bush, near Perth, Yallingup to Mammoth and Lake Caves, 31.vii.14.

This is a very abundant species in Western Australia.

Sub-family IV. *Dolichoderinae* Forel.

Iridomyrmex detectus Sm.— ☿ ☿. Mundaring Weir, near Perth, 3.viii.14; Perth, stations on railway to Busselton, 30.vii.14; Adelaide, Outer Harbour, 27.viii.14. "The entrance to the nests was very characteristic, being a single opening, leading vertically downwards, in the

centre of a bare, smooth, circular patch, from memory about a foot in diameter. Across this patch the ants ran with great rapidity in their journeys to and from the nest. Known as the 'meat ant.'"—E. B. P.

Abundant almost over the whole continent.

I. discors For.—☿ ☿. Under log or stone in bush, near Perth, Yallingup to Mammoth and Lake Caves, 31.vii.14. Also a very abundant species in West Australia.

I. conifer For.—☿. Perth, stations to Busselton; Yallingup, close to sea, 30.vii.14. An extremely abundant species in W. Australia. The nests harbour a great number of myrmecophiles.

"The nests, which were especially common near the sea at Yallingup, resembled a small *Formica rufa* nest, but the material was coarser, grey in colour, and freely intermixed with sand. Near one of the nests in this locality a crowd of ants was seen busily engaged in attacking some object. One scoop with a moderate-sized pill-box secured 32 ☿ with their prey, a Noctuid larva. The contents of the box were poured into a cyanide bottle, and, when examined later, were found to include a large larva of the Myrmeleonid genus *Palpares*. It seems probable that this predaceous insect had been attracted by the number of ants at one spot and had tunnelled towards and beneath them. Its flexible limbs suggested that it had been alive when put into the bottle."—E. B. P.

I. emeryi Crawley.—♂ ♀ ☿. This species was described in Ent. Rec. xxx. 5, p. 90, 1918. "A moderate-sized flat stone formed the roof of a chamber the floor of which was crowded with winged ♀ ♀, while the ♂ ♂ were hanging, as densely packed, from the ceiling. The close proximity of the sexes—for the chamber was low—combined with their absolute segregation, was a very striking sight."—E. B. P. In the original description the locality was given as Victoria; it should be N. S. Wales, Blue Mts., near Mt. Victoria, 23.viii.14.

I. fornicatus Em.—10 ☿ ☿, under stone, Blue Mts., N.S.W., near Mt. Victoria, 23.viii.14. Kindly determined for me by Prof. Emery.

I. itinerans Lowne, race *nitidiceps* André.—1 ☿, near Perth, Yallingup to Mammoth and Lake Caves, under log or stone in bush, 31.vii.14. The specimen is damaged, but it is almost certainly this species, which I have frequently received from the Perth district.

I. rufoniger Lowne.—4 ☿ ☿, in flower of pink Mesembryanthemum, Adelaide, Outer Harbour, 27.viii.14.

I. sp.—☿ ☿, under stone, Victoria, near Healesville, near Black Spur, 15.viii.14. I am unable to identify this species at present.

I. (*Doleromyrma*) *darwinianus* For., var. *fida* For.—8 ☿ ☿. Yallingup to Mammoth and Lake Caves, under log or stone in bush, 31.vii.14. Kindly identified by Prof. Emery.

Leptomyrmex erythrocephalus F.—1 ☿, under stone, Blue Mts. N.S.W., near Mt. Victoria, 23.viii.14 (*von Luschan*).

Turneria frenchi For.—7 ☿ ☿, under stone, Blue Mts., N.S.W., near Mt. Victoria, 23.viii.14. Not having been able to compare this striking little species with Forel's co-types, I place it with some hesitation under *frenchi*, though it agrees fairly well with the description.

Sub-family V. CAMPONOTINAE Forel.

Notoncus sp.—4 ☿ ☿, 1 ♀ alate. These 5 specimens do not quite agree with any of the published descriptions. They are very like *gilberti* For., from Queensland, but are without the striae on the thorax. There are so few representatives of this genus in our collections in this country that I let them stand over for further material. The ☿ ☿ measure 4·5 to 5·1 mm. Near Perth, Cottesloe Beach, sea to railway station, in one nest, under a stone or piece of tin.

Notoncus sp.—A single specimen, a ☿, differing from the above, but indeterminable at present. Near Perth, Yallingup to Mammoth and Lake Caves, under log or stone in bush, 31.vii.14.

Camponotus (*Myrmoturba*) *nigriceps* Sm., race *dimidiata* Rog.—20 ☿ ☿, from nest under bark of prostrate trunk, Victoria, near Healesville, 16.viii.14. 9 ☿ ☿, under stone, Blue Mts., near Mt. Victoria, 23.viii.14 (*von Luschan*). "The ant-like Hemiptera and beetles with ant-like movements (*supra*, p. 118) were found near the Healesville nest."—E. B. P.

C. (*Myrmophyma*) *testaceipes* Sm.—6 ♃, 16 ☿ ☿, under log, near Perth, Mundaring Weir, 3.viii.14.

C. (*Myrmogonia*) *claripes* Mayr, race ?—4 ☿ ☿ minor, near Perth, Yallingup to Mammoth and Lake Caves, under log or stone in bush, 31.vii.14.

Difficult to identify without ☿ ☿ major.

C. (*Myrmosphincta*) *suffusus* Sm., var. *bendigensis* For.—A single ☿ under stone, Blue Mts., N.S.W., near Mt. Victoria, 23.viii.14 (*von Luschan*).

C. (*Myrmosaga*) **ferruginipes**, sp. n.

☿ major. Length 9 mm. Deep black; masticatory border of mandibles reddish, funiculi dark red-brown, legs bright ferruginous.

Head very slightly broader than long, widest at eyes, sides feebly convex. Mandibles 6-dentate. Scapes pass the occiput by more than a quarter of their length. Clypeus feebly carinate. Anterior border very sinuate. Eyes flat, placed above the middle of sides.

Pronotum broad in front, the shoulders rather prominent and bordered. Base of epinotum $1\frac{1}{4}$ as long as declivity, saddle-shaped. Scale in profile twice as high as broad, bluntly rounded at top. From above it is wider than long.

Pilosity sparse, brown-yellow. A slight pubescence on head and gaster. Tibiae and scapes without erect hairs.

Moderately shining. Mandibles shining, with a few punctures and lines base; clypeus, cheeks, and the space between the frontal carinae have small, scattered, irregular punctures. Whole of head and thorax minutely and closely reticulate and semi-matt; on sides of thorax and on base of epinotum the sculpture has a more or less transverse direction. Scale with extremely fine encircling striae; gaster with even finer transverse striae. Legs microscopically reticulate-striate.

A single specimen, fastened, as related on p. 120, to the leg of a *Myrmecia forficata*, near Healesville, Victoria. The gaster is unfortunately somewhat damaged and some legs are missing. It is quite unlike any of the described forms of this subgenus from Australia. The *C. (M.) chalceus* Crawley, originally taken at Yallingup, comes nearest this species, but differs principally in colour. It has since turned out to be a very abundant species in Western Australia. See Ent. Rec. xxx. 5, 1918.

29 Holland Park Road,
London, W. 14.
March 1922.

IX. *New* Chrysids *from Egypt and Algeria.* By the Rev. F. D. Morice, M.A., F.E.S.

[Read May 3rd, 1916.]

Parnopes nilotica, n. sp.

Parva (long. circ. 5–6 mm.); capite et thorace viridibus et sparsim subauratis, postscutelli appendice brevissima thoracisque angulis postico-lateralibus concoloribus, tegulis alarum albidis; abdomine metallescenti-roseo vel carneo, segmentis—vel omnibus (♂! an semper?) vel solum tertio—apicem versus plus minusve virescentibus: segmenti 3tii parte apicali pallidiore (flavida), lateribus transversim ita impressis ut in medio quasi carinam relinquant, quae tamen carina in disco segmenti non continuatur; margine ipso scarioso et acutissime inaequaliter multispinuloso: antennis, mandibulis (apicibus harum nigris exceptis), ore, pedibus, et ventre flavido-testaceis, genibus vero et parte tibiarum albidis.

Cavitas facialis albo-pilosa, longitudine sua latior, lateribus (i.e. oculorum orbitis interioribus) fere parallelis. Clypei apex in medio excisus. Pronoti anguli antici in formam spinularum obliquarum excurrentes. Tegulae alarum (ut in hoc genere fieri solet) maximae, punctatae. Postscutelli apex vix mucronatus, sed tuberculo concolore parum conspicuo munitus. Caput thorax que crasse rugoso- vel reticulato-punctata; abdomen inaequaliter subtilius punctatum. Segmenti tertii partes impressae breviter albo-pubescentes: mesopleurae vero glabrae.

1 ♂, 2 ♀♀, taken by Dr. Longstaff at Khartum, 8–10. ii. 1909, and presented by him to the Hope Coll. in Oxford.

I treat this species as new on the authority of M. Robert du Buysson, who has kindly examined it for me and called my attention to several characters distinguishing it from *vareillesi*, Buyss., an Algerian form which superficially much resembles it.

In *vareillesi* the eyes are much larger, occupying more of the head, so that the face between them is narrower. They are also much wider above than beneath, while in *nilotica* they are regularly oval. Partly, no doubt, for this reason, the tempora in *nilotica* appear dilated behind the

centre of the eyes (in the lateral view). The postscutellar appendage is evidently much longer in *vareillesi*, and is also *white* (as are likewise the posterior toothlike angles of the thorax), this difference of colour from the metallic areas round it rendering it exceedingly conspicuous. In *nilotica* both the angles of the thorax and the merely tuberculate apex of the scutellum are concolorous with the parts adjacent to them (green). It is also slightly smaller than *vareillesi*; the mesopleurae are not pubescent as in that species; and the dorsulum is more largely and uniformly punctured.

It cannot be confounded with *P. schmiedeknechti*, Mocs. (from Egypt and Palestine), that species having *inter alia* the thorax above, including the tegulae, concolorous with the abdomen, and very abnormal characters in the mouth parts, which do not exist in *nilotica*.

I am, however, not altogether certain that it may not prove to be a form of *P. elegans*, Klug, described (on a single ♀) from Ambukohl, Nubia, and apparently not since rediscovered. The figure in Symb. Phys. suspiciously resembles it. But the last segment in *elegans* is described as "laete viridi-aureo," which could hardly be said of any of Dr. Longstaff's specimens. And it should perhaps be noted that *elegans* was taken in July, but *nilotica* early in February.

Chrysis modestior, n. sp.

Statura minima (long. 3–4½ mm.); segmenti abdominalis 3tii serie anteapicali foveolarum circ-12 rotundarum mediocriter distincta, apice ipso integro, edentato, subtruncato angulis lateralibus rotundatis; postscutello convexo; oculis haud magnis, breviter ac late ovalibus; genis longis, convergentibus; cavitate faciali transversa, superne haud distincte marginata (sc. carina frontali nulla), in ♂ argenteo-pilosa, in ♀ glabra, basi sulco brevi lineari longitudinaliter impressa, in medio subtiliter oblique striolata, lateribus dense rugoso-punctulatis.

Corpus superne roseo-violascenti-metallicum, punctis haud profundis sed latis reticulato-scabrum, propterea que parum nitens; infra cyaneum. Cyanea sunt etiam cavitatis facialis pars media, tegulae alarum, propodei apex atque latera (area vero huius basali subvirescenti-ignea). Genae virides. Mesopleurae subauratae, sterna vero omnia cyanea. Segmenti abd. 3tii limbus apicalis cyaneus. Venter obscure cyanescens, maculis 2 basalibus segmenti 2di violascentibus. Pedes viridi-cyanei vel cyanei, tarsis vero brunneis.

Pronoti anguli haud spiniformes, fere recti. Antennarum articulus 3tius duobus sequentibus simul sumptis fere aequalis. Alae hyalinae nervis fuscis, cellulae radialis apice clauso.

2 ♂♂, 2 ♀♀, Hammam-bou-hadjar, Algeria (Province of Oran): 21. iv. 1910.

An exceedingly small and (to the naked eye) rather duskily coloured species. I found it settling on stones at the foot of a sort of cliff where the pretty little Masarid wasp *Quartinia major*, Kohl, was abundant, and suspect that it may be parasitical on that species.

Chrysis sefrensis, Buyss. ♂.

This species was described by Vicomte R. du Buysson in the Revue d'Entomologie, August 1900, from a single ♀ taken by M. Abeille de Perrin at Ain-Sefra in Algeria (Province of Oran). I believe that it has not been since recorded, and that the ♂ is still unknown.

I was so fortunate as to meet with both sexes at a much more northern locality in the same province, viz. at Hammam-bou-hadjar, in April 1910. M. du Buysson has kindly compared the ♀ with his original type and satisfied himself of their identity, and it is at his request that I here record the hitherto unpublished ♂.

It is exceedingly like the ♀, so that a complete description of it would be superfluous. But the genae are slightly less developed, evidently shorter than the scape of the antennae, their exterior outlines (frontal view) not quite so parallel, though the convergence is exceedingly slight, and their inferior angles not so sharply prominent. In colour its only difference from the ♀, so far as I can see, is a slightly greater prevalence of the red (or coppery) tints over the green with which they are blended, especially in the head. Thus the vertex, almost the whole face, and the second joint of the antennae, are thoroughly cupreous in the ♂, while in the ♀ all these parts are more or less virescent. The third antennal joint appears to me to be altogether non-metallic, while in the ♀ it is green above like the second. As usual in the Genus, the ♂ 3rd abdominal segment is shorter and more truncate at the apex than in the ♀, and, perhaps for this reason, the four "teeth" appear shorter in proportion to their breadth; especially the exterior pair are evidently far more obtuse than in the ♀, and lie

wholly on the apical margin of the segment (not, as in the ♀, forming a portion of its lateral margin also !).

The ♂ was taken on April 27, the ♀ on April 24; both, probably, in a waste and stony patch of ground abounding in *Ferula*, but of this I am not absolutely certain, nor can I say whether they occurred on the plants or on the stones. (Most of my captures in that place, however, were on the latter, for the *Ferula* had mostly gone to seed, and ceased to be attractive to *Hymenoptera*.)

Chrysis scintillula, n. sp. ♂.

Parva (long. in ♂ circ. 5 mm.); laete viridis; tegulis alarum, suturis juxta latera propodei, pedum anteriorum tibiis, abdominisque limbo apicali quadridentato aureo-rutilantibus; etiam vertice, mesonoto cum scutello, abdominisque regionibus quibusdam dorsalibus, plus minusve (secundum lucis incidentias varias) inter viride et rutilum versicoloribus; tarsis pedum omnium antennarumque albo-pruinosarum flagellis brunnescentibus, scapis harum cum articulo tertio (quarto dimidio longiore) viridi-metallescentibus, articulo vero secundo (brevi) aureo-rutilo.

Oculi prominuli, latitudine sua paullo longiores. Genae longae, scapis antennarum subaequales, valde convergentes. Facies superne lata, carina tenui sed distincta (quae tamen ad oculos non attingit) ab ocellis separata; in medio sulco nitido longitudinali divisa; lateribus dense subtiliter punctatis; argenteo-pilosa.

Pronotum transversum, antice in medio impressum haud profunde; angulis lateralibus subacutis (non autem spiniformibus). Postscutellum simplex, fere planum.

Segmenti abdominalis tertii latera (desuper visa) fortiter a basi usque ad apicem fere recte convergentia; series anteapicalis foveolarum (in exemplari hoc octo) satis profunde impressa; dentes apicales quattuor, forma triangulari, magnitudine inter se non multum differentes, exteriores vero plus minusve introrsum deflexi proptereaque dentibus interioribus porrectis etiamque suberectis aliquanto minus conspicui.

Corporis dorsum punctis magnis crassisque—in vertice et pronoto quasi reticulatis, alibi magis inaequaliter sed fere ubique dense congregatis—, scabrum: exceptis limbo bene definito postico scutelli singulariter (an semper?) prorsus laevigato, et segmenti abdominalis 3tii apice (post foveolas) punctis magnis nullis sed tantum minutissime vix visibiliter punctulato.

(Alas, in exemplari unico casu aliquo laceratas et pertusas, describere non tento!)

1 ♂ taken by myself on *Ammi visnaga*, just outside the village of Sidi Okba, near Biskra, in Algeria (Province of Constantine): 16. vi. 1911.

The size and general appearance of this insect give it a superficial likeness to *Chrysogona assimilis*, Dhlb. (? *pumila* Klug). But the long genae at once separate it from that species; and though in my specimen the upper wings are sadly torn, and one is wanting altogether, enough remains of the other to show that its neuration is not that of a *Chrysogona* but of a *Chrysis*.

XXIV. *On the Hymenopterous genera* Trichogramma, *Westw., and* Pentarthron, *Riley*. By R. C. L. PERKINS, D.Sc., M.A., F.E.S.

[Read February 5th, 1913.]

PLATE XXXIII.

IT has for a long time been an uncertain question amongst students of the Chalcid group of Hymenoptera, as to whether the genera *Trichogramma* and *Pentarthron* are distinct, or the latter a mere synonym of the former. In the latter part of last year (1912) Prof. E. B. Poulton of the Hope Department of Zoology at Oxford was so kind as to offer me the opportunity of examining at leisure the unique type of Westwood's *Trichogramma evanescens*. The specimen is very old and bears the label "*Trichogramma evanescens*, Westw., Phil. Mag., minute sp. Chalcidiae, at Chelsea, June 11th, 1828."

A preliminary examination with a strong lens and compound miscroscope showed one fore-wing to be in good preservation, though with a good deal of dust and dirt obscuring the details of the hairy clothing. The other fore-wing was torn and the one lower wing was crumpled. A projection from the head proved to be the long scape of one antenna, but the critical joints were missing, and there were no parts of the antennae gummed on the card. After making drawings of the entire front wing, as well as could be managed without cleaning, the specimen was relaxed and much of the dirt removed. The gum with which the insect had been stuck down swelled up greatly (being probably tragacanth) and was with much difficulty separated from the insect, even the upper surface of the wing not being free from it. Subsequently the specimen was mounted in Canada balsam and fresh drawings of the wing made.

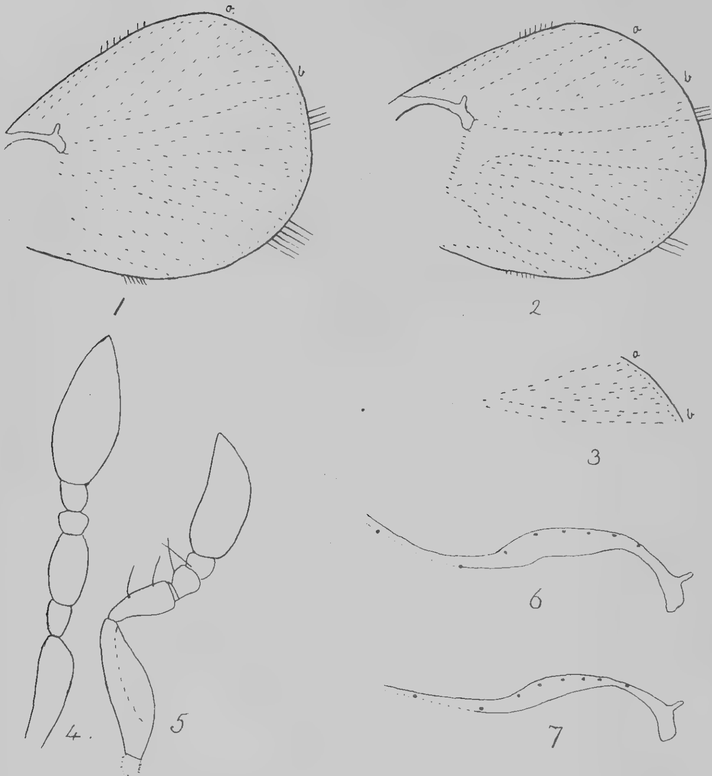
The front wing, as can be seen from figure 1, agrees in all essential characters with that of *Pentarthron*. Compared with a species of the latter from Hawaii (fig. 2) the one really notable difference is that whereas in *T. evanescens* there are only two hairs placed transversely on the

wing beneath the lower extremity of the stigmal vein, in the Hawaiian species there is a long row of these hairs, meeting at right angles (or nearly so) with the inner extremity of the second hair-line from the dorsal margin of the wing. The hair-lines, marked *a* and *b*, which converge basally to enclose a triangular space, include irregularly disposed hairs, which are rather different from those of fig, 2, and altogether less numerous than those in the same area of *P. flavum* of Hawaii, shown in fig. 3. Whether the differences in the clothing of this area are even of specific value is very questionable. It is worth remarking that in all Hawaiian forms of *Pentarthron*, however they may differ in colour of body or wings, the transverse hair-line from the lower end of the stigmal vein always remains conspicuous and consists of many hairs.

The neuration of *Trichogramma* and *Pentarthron* appears identical, for the apparent form of the veins appears a little different in different examples of a species, owing to slight differences in mounting, the pressure on the wing, etc. In fig. 6 the neuration of *P. flavum* is shown, in fig. 7 that of *T. evanescens*. The position of the macrochaetae, indicated by black dots, is practically the same and their number (8) is also the same in each. The marginal cilia of the fore-wing are slightly longer in *T. evanescens* than in Hawaiian *Pentarthron*.

It is much to be regretted that the antennae of the type of *Trichogramma* are wanting, as these organs alone could absolutely settle the question of the identity of the two genera or their distinctness. Fig. 4 is the antenna of *T. evanescens* after Westwood,* and it is extremely different from that of *Pentarthron* (antenna of *P. flavum*, fig. 5), nor is it like the antenna of any Trichogrammid with which I am acquainted. The antennae of all the forms of *Pentarthron* ♀ I have examined are very similar, consisting of a long scape, an elongate pedicel, followed by an extremely short transverse ring-joint, two short funicle joints and a great solid club, or 6 joints in all. Westwood

* Since this was written I have seen the figure of *T. evanescens* (presumably copied from Westwood's paper) in Wytsman's Gen. Insectorum. This figure represents the antennae quite differently from that in Westwood's "Classification," and the whole insect bears no resemblance to the type specimen. In fact it is so unlike, that it cannot even be considered as a caricature of the species.



R. C. L. Perkins, del. *C. Hentschel.*

TRICHOGRAMMA, Westw. and PENTARTHRON, Riley.

figures no ring-joint, but its position is occupied by a great elongate funicle joint, longer than the two following together.

In spite of this I believe that *Trichogramma* and *Pentarthron* will prove to be the same, for the antennae of Trichogrammids usually distort and shrivel (often beyond recognition) on drying, and even in balsam preparations, unless they are carefully prepared, are often far from satisfactory. Westwood's figure is drawn with the antenna forming a straight line, but I suspect that it was made from a specimen in which the pedicel was partly hidden beneath the scape. In a specimen that I possess, this gives an appearance of a division of the large pedicel joint, rather similar to the 2nd antennal joint, that he figures. The regular fringe of hairs that he gives to the two short funicle joints, is probably due to clothing, similar to that found in *Pentarthron*, viewed in a particular way. In some aspects it may be seen also on the club of the latter.

No doubt Lepidopterists, who have collected eggs of moths, especially those of *Pyralidina* and *Tortricina*, in the field, must have often bred British examples of *Trichogramma*, and I should be very glad to receive examples of these for comparison with the type. Being amongst the smallest of all known insects many specimens may emerge from a single moth's egg.

Explanation of Plate XXXIII.

Fig. 1. Front wing of *Trichogramma evanescens*, Westw. The marginal cilia are only partly shown, so as to indicate their length at different parts of the wing-margin.

2. Front wing of *Pentarthron* sp. from the Hawaiian Islands.
3. Portion of front wing of *P. flavum*, Perkins, from the same locality.
4. Antenna of *Trichogramma evanescens*, Westw. (from the figure in his "Introduction to Modern Classification of insects," vol. ii, p. 155, fig. 9). The hairs on the funicle are omitted.
5. Antenna of *Pentarthron flavum*. Four conspicuous setae on the pedicel and funicle joints are shown.
6. Neuration of *P. flavum*.
7. Neuration of *T. evanescens*.

Boletín de la Sociedad Aragonesa de Ciencias Naturales.—Marzo de 1914

Algunos Neurópteros del Museo de Oxford

POR EL R. P. LONGINOS NAVÁS, S. J.

I SERIE

En estas notas consignaré los Neurópteros que del Museo de Oxford haya recibido para su estudio y merezcan mención especial o por su novedad o rareza o por alguna otra circunstancia digna de tenerse en cuenta. La enumeración se hará agrupándolos por familias y tribus.

Fam. MANTÍSPIDOS

Trib. MANTISPINOS Nav.

1. **Mantispa pictiventris** Gerst.

Australia: «N. S. W. Sydney, 10 m. 3. of. alt. 100 fect, Oatley, Capt. 23 Nov. 1903, J. J. Walker, R. N.»

2. **Mantispa crucifera** sp. nov.

Flava.

Caput oculis plumbeis; antennis fuscis, duobus primis articulis flavis; vertice fusco-rufo, linea transversa longa et alia brevi longitudinali, fere in ⊥, flavis.

Prothorax inferne flavus, superne fusco-ruber, verruculatus, breviter pilosus, prozona margine antico rotundato et duabus striis longitudinalibus flavis; metazona duplo longiore, retrorsum leviter dilatata. Meso-et metanotum testacea, ad latera fuscescentia. Pectus flavo-testaceum.

Abdomen inferne flavum, linea longitudinali fusca; superne testaceum, tribus lineis longitudinalibus, parum definitis, media interrupta, fuscis; cercis ♂ cylindro-conicis, testaceis.

Pedes flavi, flavo pilosi, femoribus anticis duabus maculis internis nigris, posteriore ad primam spinam, anteriore ad apicem; tibiis anticis interne subtotis nigris.

Alæ angustæ, apice ellipticæ; reticulatione fusca, ad basim flava; stigmate elongato, rubro, interne obscuriore.

Ala anterior venulis costalibus 7; sectore radii fere 5 ramis; venulis gradatis 10.

Ala posterior venulis costalibus 5; sectore radii 5 ramis; venulis gradatis 9.

Long. corp. . . .	7-10	mm.
— al. ant. . . .	8-11'5	»
— — post. . . .	7-10'5	»

Patria. «Tasmania, about 100 ft. Plenty, abt. 30 m. N. W. of Hobart, on Derwent Riv.» Julio 1902, J. J. Walker.

Nota.—Según el tamaño es bastante variable el número de ramos del sector del radio y consiguientemente de las venillas gradiformes, habiendo menos de lo que se ha indicado en la descripción, en los ejemplares pequeños.

3. **Mantispilla tenella** Erichs.

«Cape Colony. East London, 1-2 miles E. of, on Sandhills». 29 Sep. 1905, G. B. Longstaff.

4. **Mantispilla hæmatina** sp. nov.

Caput facie flava, linea longitudinali fusca; palpis flavis; antennis duobus primis articulis flavis, ceteris ferrugineis (ultimi desunt); fronte et vertice subtotis fusco-rubris, lineola inter antennas et circum oculos, flavis; oculis fuscis.

Prothorax elongatus, lævis, inferne testaceo-ruber, superne flavo-testaceus; prozona brevi, margine antico convexo, vix medio angulato, flavo; fascia transversa anteriore, lateraliter cum linea postica transversa concava, fusco-rubris; metazona triplo longiore, cylindrica, transverse rugosa, linea duplici dorsali longitudinali fusco-rubra Mesonotum subfuscum, proscuto transverso, in angulum sive tuberculum lateralem antrorsum producto, flavo; scutello flavo. Metanotum rubellum. Pectus rubrum.

Abdomen rubrum, superne fusco-maculatum.

Pedes flavi. Coxæ anticæ inferne fusco-rubræ. Femora antica superne, interne et linea externa juxta spinas, fusco-rubris. Coxæ et femora media et postica sanguinea.

Ala anterior venulis costalibus 6-7: sectore radii 4 ramis, 1, 2, 1 ex cellulis radialibus 1, 2, 3 procedentibus; venulis gradatis 8.

Ala posterior sectore radii 5 ramis; venulis gradatis 8.

Long. corp. ♀ . . .	3'5 mm.	
— al. ant. . . .	11	»
— — post. . .	9'4	»

Patria. Africa meridional: «Salisbury, 5.000 feet, Mashonaland». Sept. 1900, G. A. K. Marshall.

5. **Nocyla sacra** sp. nov.

Flava.

Caput linea longitudinali in fronte et in labro rubro-fusca; oculis æneis; vertice fusco-rubro lineato; antennis flavis, aliquot articulis ad medium et 7 ultimis fuscis.

Prothorax elongatus, totus punctis fuscis verruculatus, flavo breviter pilosus; prozona brevi, tribus lineis longitudinalibus fusco-rubris; margine antico late rotundato; metazona saltem triplo longiore; inferne linea longitudinali media fusco-rubra; fortiter rugosa, spatio oblongo laterali in medio anteriore lævi, tuberculis destituto. Meso-et metanotum ad latera fusca.

Abdomen flavum, superne fascia laterali et macula dorsali ad apicem aliquot segmentorum, fuscis; cercis ♂ brevibus, flavis.

Pedes coxis anticis superne et externe tuberculis exiguis fusco-rubris ad pilorum insertionem; femoribus anticis interne totis ferrugineis; spinis flavis, femoribus tibiisque mediis et posticis atomis minutissimis fuscis ad pilorum insertionem; unguibus posticis tridentatis, dente medio ultimo multo longiore.

Alæ hyalinæ, ellipticæ; reticulatione fusco-rubra; stigmate triangulari oblongo, flavido, ad subcostam ferrugineo, ferrugineo piloso, venulis costalibus 6-7, gradatis 7.

Ala anterior sectore radii 3 ramis, 1 ex prima cellula, 2 ex secunda ortis.

Ala posterior sectore radii 3 ramis, 1, 2, 1 ex cellulis 1, 2, 3 ortis.

Long. corp. ♂ . . . 8 mm.
— al. ant. . . . 9'5 »
— — post. . . . 8'2 »

Patria. Palestina. Rev. O. P. Cambridge, 1865.

6. **Necyla natalensis** sp. nov.

Caput facie testaceo-rubra, stria media longitudinali fusca ad clypeum et ad labrum; palpis flavis; antennis testaceis, medio et apice fuscis (seu fere 5 articulis ad medium et 5 ad apicem fuscis); vertice fusco, testaceo vario; oculis æneis.

Protherax elongatus, flavo breviter pilosus, inferne et leteraliter testaceus: fascia dorsali longitudinali fusco-nigra; prozona brevi, parum dilatata, margine antico anguloso; metazona triplo vel amplius longiore cylindrica, tenui, rugosa. Meso-et metathorax superne fusco-nigri, inferne testacei.

Abdomen testaceum, fascia dorsali longitudinali fusco-nigra; cercis ♂ brevibus, flavis.

Pedes flavi, flavo pilosi; femoribus anticis mediocriter crassis, superne linea longitudinali fusca, interne subtotis fuscis. Pedes medii et postici fusco pilosi. Ungues postici 5-dentati, unguibus lateralibus brevibus.

Alæ hyalinæ, ellipticæ; reticulatione fusca; venis proxime ante stigma flavis; stigmate triangulari parum elongato, rubello, fusco piloso, ad medium fusco-rubro.

Ala anterior venulis costalibus 7; sectore radii 3 ramis; venulis gradatis 6.

Ala posterior sectore radii 4 ramis; venulis gradatis 6.

Long. corp. ♂ . . . 8 mm.
— al. ant. . . . 9 »
— — post. . . . 7'8 »

Patria. Africa meridional. «Natal, 7-800 ft., near Durban», Malvern», G. A. K. Marshall.

7. **Climaciella 4-tuberculata** Westw.

India. Un ejemplar algo grande. Long. del ala ant. 17 mm.

8. **Campion** gen. nov.

En obsequio del B. Edmundo Campión, S. J. uno de los más insignes alumnos de la Universidad de Oxford.

Antennæ insertione distantes plus quam latitudine primi articuli, tenues, articulis transversis.

Prothorax elongatus, prozona brevi, metazona saltem duplo longiore.

Abdomen ♂ cercis manifestis.

Coxæ anticæ divisæ. Tibiæ posticæ calcaribus brevibus. Ungues postici arcuati, haud dentati.

Alæ angustæ, stigmate elongato, radio apice ramoso; area apicali lata, venulis aliquot furcatis aut ramosis; area radiali angusta; cellula radiali primaria elongata, 3-4 cellulis divisa; sectore multis ramis.

Ala anterior cubito apice furcato et ramoso; postcubito et axillari apice furcatis.

Ala posterior procubito apice ramoso; cubito parum curvato, venula cum furca postcubiti conjunto.

N. B. Este género por la forma de las alas se acerca a los géneros *Euclimacia* Enderl. y *Nampista* Nav., pero por la del protórax y uñas posteriores se aparta mucho de ellos.

El tipo es la especie siguiente.

9. **Campion rubellus** sp. nov. (fig. 1).

Caput facie testaceo-rubra; palpis flavis; antennis testaceo-rubris, duobus primis articulis flavis; oculis fuscis; vertice ferrugineo.

Prothorax inferne flavus, lateraliter rubellus, superne ferrugineus; prozona brevi, parum dilatata, margine antico rotundato; metazona triplo saltem longiore, transverse fortiter rugosa, retrorsum leviter dilatata, apice ferrugineo-testacea. Meso-et metanotum fusco-ferruginea; mesonoti proscuto lateraliter in tuberculum acutum antrorsum producto. Pectus inferne testaceum.

Abdomen inferne testaceum, superne ferrugineum; cercis

♂ (fig. 1, a) conicis, inflatis, margine interno denticulatis, apice in dentem internum tenuem flexis, testaceis; lamina subgenitali transversa, apice late rotundata, flavida.

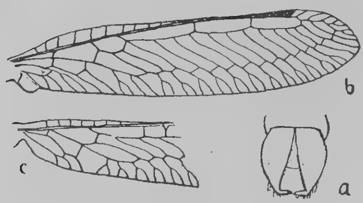


FIG 1
Campion rubellus Nav.
a. Extremo del abdomen ♂.
b. Ala anterior ♀ × 2'5.
c. Base del ala posterior.

Pedes testacei; femoribus anticis mediocriter incrassatis, externe ferrugineo vage maculatis; spinis apice fuscis; femoribus mediis et posticis testaceo-rubris.

Alæ angustæ, apice ellipticæ; membrana fulvo leviter tincta, ad basim flavescente; reticulatione fusco-rubra; stigmate triangulari elongato, rubro sanguineo.

Ala anterior (fig. 1, b) area costali 10 venulis; sectore radii 10 ramis flexuosis; venulis gradatis 16; lobulo axillari prominulo, rotundato; macula exigua ferruginea ad angulum axillarem obtusum.

Ala posterior venulis costalibus 7; ramis flexuosis 10, quorum 3 ex prima cellula orti; venulis gradatis 14

		♂	♀
Long. corp.		15 mm.	23'5 mm.
—	al. ant.	15 »	21 »
—	— post.	13 »	18'5 »

Patria. Australia: «N. S. W. Sydney, 18 m. S. of 0-100 fb., National Park» 6 Diciembre 1902, J. J. Walker. He visto otro ejemplar ♂ de Australia del Museo de Londres.

Fam. RAFÍDIDOS

Trib. RAFIDINOS Nav.

10. **Agulla** gen. nov.

Prothorax fortis.

Ovipositor corpore brevior.

Tarsi primo articulo longo, secundo subduplo breviore, tertio brevissimo, bilobato, quarto gracili.

Alæ stigmate venula obliqua diviso; thyridio ad apicem venulæ primæ intermediæ; sectore radii 3 ramis; 5 cellulis discalibus.

Ala anterior cellula radiali primaria venulis radialibus in duas divisa, prima seu interiore duos ramos emittente; ramis anterioribus procubiti ramosis; cubito simplici; postcubito et axillari apice furcatis; 3 cellulis procubitalibus.

Ala posterior cellula radiali primaria in tres divisa, quarum secunda seu media duos ramos emittit; 2 cellulis procubitalibus; ramis cubiti ramosis.

El tipo es la especie siguiente.

La configuración de las alas es distinta de todos los demás Rafidinos, en los cuales el sector del radio no tiene más que dos ramos, y a lo sumo uno en cada celdilla radial secundaria, por lo cual las celdillas discales son tres, rara vez cuatro.

11. **Agulla Bagnalli** sp. nov. (fig. 2).

En obsequio del Sr. Bagnall, del Museo de Oxford, a cuya amabilidad debo el estudio de estos insectos.

Caput ovale, depressum, oculis prominulis, fusco-castaneum, ocellis concoloribus; linea transversa testacea ad clypeum, labro margine antico testaceo; vertice minute granuloso; occipite callo longitudinali medio ferrugineo.

Prothorax magis quam duplo, haud triplo longior quam latior, minutissime granulatus, retrorsum leviter ampliatus, fusco pilosus; inferne testaceus; superne medio anteriore ferrugineus, medio posteriore fuscus, tribus lineis apicalibus longitudinalibus ferrugineis, media breviore. Meso-et metathorax fusci, marginibus posticis ferrugineis; mesonoti proscuto ferrugineo.

Abdomen fuscum, inferne in ♂ margine postico segmentorum flavo, in ♀ apice ferrugineo; valvis genitalibus ♂ flavis, ovipositore forti, fusco, corpore breviore.

Pedes fusco pilosi; femoribus in ♀ fuscis, in ♂ testaceis; tibiis tarsisque flavidis.

Alæ (fig. 2) ellipticæ; reticulatione fusca, ad basim ferruginea; stigmate elongato, interne recto, externe obliquo, flavo-testaceo; venula obliqua, interdum furcata a tertio basilari marginis posterioris ad tertium apicale marginis anterioris diviso; subcostæ apice a stigmate parum distante, fere latitudine stigmatis aut paulo amplius; venula radiali ante stigma minus ab eo distante; ramis ad marginem externum furcatis aut ramosis; ramo apicali primo seu apice radii furcato, ad marginem anteriorem veniente.

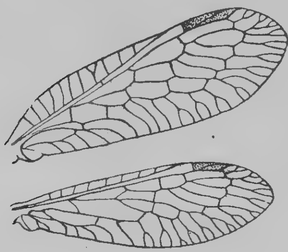


Fig. 2
Agulla Bagnalli ♀ Nav.
Alas.
(Mus. de Oxford).

Ala anterior area costali ante medium dilatata, 11-12 venulis; venulis gradatis (omissa radiali ultima) 5, angulo axillari obtuso, nubecula exigua ferruginea notato.

Ala posterior similiter constructa; area costali angusta, sensim angustata, 8 venulis; venulis gradatis (radiali ultima non numerata) 5; aliis 4 venulis ad medium alæ vel ante, fere in lineam transversam positis.

	♂	♀
Long. corp. . . .	12 mm.	16 mm.
— al ant . . .	13 »	15 »
— — post. . .	12 »	13 »
— ovipos . . .		9 »

Patria. Oceanía: «Vancouver J., Victoria, B. C. 1894-97,» Dr. E. Crompton (Mus. de Oxtord).

Zaragoza 3 de Enero de 1914.

[*Reprinted from the 'Entomologist's Monthly Magazine,'* 3rd ser., vol. iv.]

THE BUTTERFLIES OF THE OXFORD DISTRICT.

BY JAMES J. WALKER, M.A., R.N., F.L.S.

The varied geological formation of the country immediately adjacent to Oxford, and its rich flora and extensive tracts of woodland, some of them dating from very ancient times, are eminently favourable to butterfly-life; while the number of able resident collectors and observers, as well as the constant succession of enthusiastic young entomologists supplied by the University up to the commencement of the present war, has ensured its being one of the most thoroughly worked districts in the British Islands. Unfortunately the only fairly complete list of the local *Lepidoptera*, published in the Report of the Ashmolean Natural History Society for 1898, gives no details beyond the initials of the captor or observer of each species; but I found it of much service when, in 1912, I compiled a sketch of the insect fauna of the Oxford district for the use of the guide-book issued to the members of the International Congress of Entomology held here in that year, and of this the present paper, as far as the *Rhopalocera* are concerned, may be regarded as a reproduction, amplified and brought up to date where requisite. The list of *Lepidoptera* in the Victoria County History of Berkshire (1905), mainly compiled by Messrs. A. H. Hamm and W. Holland, though dealing with only a portion of the district, has also been of very material assistance in compiling these notes.

Of our 67 species of butterflies regarded as truly British, we now have definite records of 44 as having been observed in recent times within a radius of 10 miles from Carfax, the centre of Oxford, in addition to two or three species which may have formerly occurred within these limits. This tract of country is about equally divided by the Isis between the counties of Oxfordshire and Berkshire, and attains its highest elevation, 562 feet, at Shotover Hill, about three miles east of the city. It is well within sight of the beautiful and productive chalk ranges of the Chilterns and the Berkshire Downs, but does not include any portion of either; though one or two of the characteristic butterflies of the chalk, as *Agriades corydon* and (possibly) *Zizera minima*, have wandered from thence and have established themselves in outlying stations in the District. On the whole, our Oxford butterflies appear to hold their own very well from year to year, despite the fact that much of our old woodland has been drastically thinned out, and in great part replanted with uninteresting and unproductive Conifers.

Both *Pieris brassicae* and *P. rapae* are of course plentiful throughout the district, but, especially the former, vary greatly in that respect

in different years; and their abundance here is no doubt largely affected by the vigorous crusade against them by school children, "head-money" for no fewer than 6000 "white" butterflies having been paid to one parish school alone, during the present year. In the autumn of 1917 the larvae of *P. brassicae* were most abundant, but were infested with the parasite *Apanteles glomeratus* to such an extent, that it is doubtful whether 1 per cent. of the whole number were able to reach the pupa state. *P. napi* is the commonest butterfly of our flowery water-meadows and river banks, and as usual exhibits a great range of variation in intensity of markings; in July 1910 I took at Cothill, Berks, an albino example of a clear creamy-white colour, without a single black scale in any part. *Euchloë cardamines* is also plentiful in most years, and is a conspicuous and beautiful feature of our grassy lanes and wood openings in May and June, specimens in good condition being sometimes seen well into July. *Colias edusa* and *C. hyale* are very uncertain in their appearance, and are never as plentiful as on the South Coast, but the former occurs sometimes in fair numbers, as was the case with *C. hyale* in the lucerne fields near Cowley in 1901 and 1902; and a fine specimen of the latter species was observed by Mr. J. Collins and myself in August 1911 at Weston-on-the-Green, Oxon (Ent. Mo. Mag. 1911, p. 217). *Gonepteryx rhamni* is common throughout the District, and specimens newly awakened from their winter sleep may often be seen in the main thoroughfares of Oxford on bright days in February and March, while tbe larva may be found readily enough on the buckthorn bushes at the proper season.

Apatura iris is by no means common, but has been taken at intervals in Bagley and other large woods, and Mr. A. H. Hamm on one occasion saw a fine ♀ on one of the roads near Shotover Hill; and on August 10th of the present year I saw a battered ♀ in a wood near Forest Hill, Oxon, where the butterfly had been previously seen by Mr. Collins, who also reported *Limenitis sibylla* from the same wood; the latter species has also occurred at Bagley Wood and near Radley. *Polygonia c-album* is also a rare visitor to the District, but it appears to be not uncommon at Wychwood Forest, Oxon; I saw two specimens, and caught one, on bramble-blossom near Tubney Wood, Berks, on August 12th of this year, and my friend Lieut. E. G. R. Waters took a fine example at Wytham Park on September 27th. *Eugonia polychloros* has been found in both the larva and perfect states in the immediate neighbourhood of Oxford, but is decidedly rare, and my experience of the butterfly is confined to the sight of a specimen in one of the main roads in 1911. *Aglais urticae* is usually plentiful, but in

some years, as in 1916, is quite scarce, while *Vanessa io* is generally abundant—much more so, in fact, than I used to find it in Kent. I have no definite record of *V. antiopa* from Oxford itself, but in the University Museum collection there is a very fine specimen taken by the Rev. J. W. B. Bell in August 1900 on a sugared post at Pyrton, near Watlington, and just outside our limits. *Pyrameis cardui* and *P. atalanta* are as irregular in their appearance here as elsewhere, the latter being the more "dependable," but during the present year it has been most markedly rare, as I have not seen a single specimen myself, and have heard of but one or two at most as having been observed. *Dryas paphia* is common in the larger woods, but I saw a specimen in my own garden in July last, and on August 10th of this year, though then mostly in worn condition, it was as numerous near Forest Hill as in the New Forest a few weeks earlier. *Argynnis adippe* also abounds in Bagley and Tubney Woods, and in 1905 I took at the latter locality a beautiful variety of the ♂, having the basal and central black markings of both wings almost entirely suppressed. *A. aglaia* is decidedly rare, but has been observed this year in the large woods beyond Forest Hill by myself and others. *Brenthis euphrosyne* is abundant in most of our woods in May; a curious variety of a clear pale ochreous ground-colour above and beneath, now in the University Museum, was taken in Tubney Wood by the Rev. C. F. Thornewill on May 29th, 1916. *B. selene* is less common and more local, but occurs freely in damp spots in Tubney Wood; in the very hot summer of 1911 a partial second brood of small specimens appeared in August, of which there is a good series in the Museum. *Melitaea aurinia*, which formerly occurred at Bagley Wood, Headington Wick, and other localities in the district, now appears to be confined to a limited area near Cothill, Berks, where it varies greatly in numbers in different years. Although constantly on the spot from 1905 onwards, I did not see a specimen before May 22nd, 1909, when I found it flying in abundance, and very fine and variable; for several seasons afterwards it continued to appear more or less plentifully, but had become very scarce, or apparently absent from about 1914 until the present year, when it reappeared in something like its former abundance on May 25th.

Melanargia galatea is distributed over a considerable area of level country between Abingdon and Tubney, where it is found in abundance in grassy lanes, sandy and boggy fields, and is even a common roadside butterfly; it also occurs commonly in several places in Oxfordshire, as at Holton stone-pits near Wheatley. On the other hand, *Pararge aegeria* is singularly scarce, as I have heard of the occurrence of only

one or two examples in our neighbourhood, though some of our woods appear eminently adapted for it. *P. megaera* is in some years also rather scarce, though in others, notably in 1917 and the present season, it has been exceedingly numerous, especially in the second brood. *Epinephile ianira* is abundant throughout the District, and a partial second brood of richly coloured specimens is sometimes observed in hot summers. *E. tithonus* is abundant in lanes and on roadsides, and *Aphantopus hyperanthus* in most years is very plentiful at bramble-blossoms in the woods; the var. *arete* is occasionally met with at Bagley, and I have taken a curious pale fuscous form at Cothill. *Coenonympha pamphilus* is, as usual, plentiful in dry places, but I have seen no striking variations of this species.

Zephyrus betulae is somewhat uncommon, but has been observed in more than one of our woods, and has its headquarters at Bagley; *Z. quercus* being much more common and widely distributed, and occurring occasionally in numbers (*cf.* Ent. Mo. Mag. 1918, p. 211). The entomological event of the present year is the discovery by a schoolboy, Walter Burrows, of *Strymon pruni* on June 23rd in a remote and not very accessible wood near the limits of our District; he kindly disclosed the locality to the Museum staff, and in consequence I had the pleasure on July 3rd of seeing this very interesting little butterfly alive for the first time, and of taking three or four good specimens on the blossom of the privet. *Thecla w-album* is fairly common about elms, and on bramble and privet-blossom at Radley, Besselsleigh, and Tubney, and *Callophrys rubi* is plentiful in woody places. *Rumicia phlaeas*, abundant in most years (especially so in 1911) sometimes presents very interesting variations, the var. *radiata* Tutt having occurred to me more than once at Tubney, and in the Museum is a beautiful example of the silvery-white form usually known as *schmidtii*, which was taken by Mr. W. Holland at Hen Wood, Berks, in August 1903. *Aricia astrarche* is common, especially at Tubney, and *Lycaena icarus* is usually plentiful in grassy places, but has been decidedly scarce this season. *Agriades corydon*, so abundant on the chalk hills beyond our limits, was up to 1916 known only from the District by single examples found casually on Shotover Hill and elsewhere, but in August of that year I found a station for the species on a limestone down between Headington and Stanton St. John, Oxon, where it is not rare, though very local. *Cyaniris argiolus* frequents the Oxford gardens and the "Parks," as well as the more rural lanes, and has of recent years become exceedingly common, especially in the spring brood, which is sometimes fully out in April; this year it appeared, with *Pieris rapae*

as early as March 23rd. *Zizera minima* has been recorded for the District in the "Ashmolean" list by the late Mr. F. W. Lambert, but is evidently local and rare, and I know of no recent captures of the species.

One of the most interesting of our smaller woodland butterflies is the lively little *Nemeobius lucina*, which may be called abundant in places where primroses and cowslips grow freely at Bagley and Tubney Woods, Cothill, Wytham Park, &c., in May and early June. *Hesperia malvae* and *Thanaos tages* are both common, especially in the open parts of Wytham Park; and *Adopaea thaumas* and *Augiades sylvanus* are equally or more plentiful as well as more generally distributed.

Two other butterflies may at a former period have had a claim to a place on our Oxford list, though they have certainly not been observed in the District in recent years. Bagley Wood is given as a locality for *Melitaea athalia* in Morris's "British Butterflies," but the nature of the ground looks, to say the least, unlikely for this species, and its usual food-plant, *Melampyrum pratense*, is decidedly uncommon in the neighbourhood of Oxford. *Carterocephalus palaemon* was certainly met with in past years not rarely at Wychwood Forest, Enstone, and one or two other Oxfordshire localities, and probably still exists in some of these stations; but the rumour that it was formerly taken in Bagley Wood still lacks confirmation.

Aorangi, Lonsdale Road,
Summertown, Oxford.
October 15th, 1918.

Reprinted from 'The Entomologist,' Vol. LIII, July, August and September, 1920.

SOME NOTES ON THE COLLECTION OF BRITISH MACRO-LEPIDOPTERA IN THE HOPE DEPARTMENT OF THE OXFORD UNIVERSITY MUSEUM.

By F. C. Woodforde, B.A., F.E.S.

The original source of this collection was the presentation to the Oxford University in 1849 by the Rev. F. W. Hope of all his very extensive collections of books, prints and zoological specimens, including that of the British Lepidoptera. This latter he augmented in 1857 by the purchase of the private entomological collection of Mr. J. O. Westwood, and the two were henceforward known as the "Hope-Westwood Collection."

In 1861 Mr. Hope founded and endowed the Hope Professorship of Zoology, and, exercising the right conferred by the Trust Deed, appointed the illustrious Curator, J. O. Westwood, to the Chair. At his death in 1893 he was succeeded by Dr. E. B. Poulton, D.Sc., F.R.S., etc.

The Hope Collections, at first housed in the Taylorian Buildings, were transferred about 1860 to the New University Museum which had just been completed. Thus originated the Hope Department of Zoology, greatly enlarged in 1894 by the addition of rooms formerly used by the Mathematical Professor, and again in 1912 by including the southern part of the old Radcliffe Library.

Later the Rev. F. M. Spilsbury, who died in 1878, left his entomological collection to the Hope Department, and this was combined with the Hope-Westwood Collection.

During the present century very large additions have been made to the entomological collections by bequest and gifts.

In 1906 the extensive British collection formed by J. C. and C. W. Dale was bequeathed by the latter to the Museum with the stipulation that it was to be kept whole and intact and not incorporated with other collections. Detailed notes on this collection were published in the 'Entomologist's Monthly Magazine,' 1907–1910, by Commander J. J. Walker, M.A., R.N.

In 1908 the collections formed by the late Mr. A. J. Chitty were presented unconditionally to the Museum by his widow, and in 1909 that of the late Mr. H. S. Sellon was given, also without condition, by his mother and sisters. In 1915 the collection of the late Mr. Pogson Smith, Fellow of St. John's College, Oxford, was similarly presented by his widow, and in the same year the collection of the late Prof. Meldola, F.R.S., was bequeathed by him to the Museum also without conditions attached. Finally, last year the collection of the late Lieut. R. J. Champion, of Jesus College, Oxford, who was killed in France during the war, was presented by his parents, also unconditionally. Furthermore, large additions have been made by the kindness of many private collectors. All these collections, with the exception of that formed by the Dales, have now been incorporated into one, and are contained in upwards of 500 drawers in more than twenty cabinets.

The specimens of each separate collection are at once identifiable by their labels, so that nothing is lost by incorporation, but on the contrary much is gained by the opportunity of easy comparison with other individuals from other collections. Ample space has been left for future additions, the aim being to represent, as far as possible, each species by a short series of specimens from every locality in its area of distribution in the British Isles.

The classification and nomenclature is that adopted by

South in 'Butterflies and Moths of the British Isles,' except for the Geometræ, for which group L. B. Prout in Seitz's 'Macro-Lepidoptera of the World' has been followed. Before entering upon more detailed description of species and particular specimens it may be observed that with a very few exceptions every species that has occurred in the British Isles is represented in the combined collections. Unfortunately before 1880 very few collectors labelled their specimens and accurate data of most of the specimens in the older collections were wanting, but even in these some of the very rare specimens have good data attached. As an eminent exception mention must be made of the great naturalist, William John Burchell, who, nearly a century ago, labelled his small collection of British Lepidoptera with the same accuracy and minuteness as the specimens in his vast exotic collections, which are also in the Hope Department. Even in the later collections many specimens which would otherwise have been of great value were unlabelled. And here perhaps, as a digression, attention may be called to the importance of accurate and minute data. Many collectors even of the present day seem to consider it sufficient to label their specimens with the locality and the year of capture, but for insects that have more than one generation in a year, the date of the year alone is of no use for the study of the very interesting subject of seasonal dimorphism—the dates of the month and the day of the month are essential. Taking the collection as a whole, however, by far the larger proportion is well furnished with accurate data, labels being attached not only to the insect itself, but a label also being pinned by the side so that the data are clearly legible to the observer. Historically, also, the collection is interesting, there being in the Hope Collection many specimens and some of the types of Haworth, and also some of Doubleday's specimens.

PAPILIONIDÆ.

Papilioninæ.

Papilio machaon.—Twenty-four specimens, mostly from Cambridge fens, but 4 from Norfolk Broads, presented by the late Major R. B. Robertson. Very little noteworthy variation, but one very pale cream, almost white, bred by the late Lieut. R. J. Champion.

P. podalirius.—Two specimens in the Hope Collection, both unlabelled. The following is a quotation from Barrett's 'British Butterflies': "The Rev. F. W. Hope records that he has a specimen which he took at Netley (Shropshire), and also that he had two larvæ feeding on wild plum, but it does not appear whether they were reared."

PIERINÆ.

Aporia cratægi.—Forty-three specimens. Five from the Hope Collection, 11 from the Spilsbury, 9 from the Chitty, 10 from the Sellon, all without data. From the Meldola Collection are 8, 5 of which are labelled: 1 "Wales," but no date; and 4 "New Forest, Lyndhurst, 1875."

Pieris brassicæ.—A long series from many localities. A series of eight from the Isle of Wight labelled as a third brood from ova deposited in August, 1898, and as emerging October 13th, 1898. All of these are rather small. No remarkable variation, except that one male has a small black spot on the fore wings corresponding in place with the upper spot on the fore wing of the female. It was bred at Lee, North Devon, May 3rd, 1897, by Prof. Selwyn Image.

P. rapæ.—A long series of upwards of 100 from many localities among them a *quite* spotless male with the usual dark mark at the apex of the fore wings only indicated by a few grey scales, taken at Finchley, April 15th, 1893, by Dr. F. A. Dixey, F.R.S. Another very similar male from North Staffordshire, May 5th, 1917, taken by myself. In both the black spot on the costa of the hind wings is wanting. Several cream or pale buff-coloured females from various localities. A female with a third spot in the fore wings between the usual two, taken by myself in North Staffordshire. Several dwarfs.

P. napi.—A very long and varied series, from England, Scotland and Ireland. A *very* small female in the Sellon Collection taken in the New Forest in July, 1892. Another very slightly larger taken by Mr. Holland near Reading, in July, 1893, and three other dwarf specimens taken by myself in the New Forest. A very heavily marked female with the tips of the fore wings quite black, not grey, the base of the fore wings heavily suffused with grey; the veins of the hind wings pale, inconspicuous except near the edges of the wings, where they are quite black; north Staffordshire, August 7th, 1917, taken by myself. Another very similar from Perthshire, August, 1905, from the Meldola Collection. A long series from many parts of Scotland in which are many fine varieties from the Meldola Collection. A series of four very finely marked specimens from Enniskillen, bred by H. Main, presented by the late A. Harrison. One of the males has a supernumerary spot at the inner angle of the fore wings in the same position as the normal black spot of the female. A dark cream-coloured female from Tyrone.

P. daplidice.—Nine specimens, 4 from the Hope and 3 from the Spilsbury collections, without data. One from the Chitty Collection labelled, "Taken by a labourer near Brighton." Another labelled, "Berks, Ascot. Capt. July, '97, by J. Paterson, a schoolboy. Presented 1900 by H. A. Ormerod."

Euchloë cardamines.—A long series from many localities, but very little variety, except three very small specimens.

Leucophasia sinapis.—A long series of upwards of 100, including many ab. *diniensis.* Two specimens approach very nearly to ab. *erysimi,* having only a very few scattered grey scales at the apex of the fore wing.

Colias hyale.—Upwards of 70, chiefly from Sussex and Kent, but including a fine series of 15 from Oxford taken by Mr. A. H. Hamm. There is also a pale buff-coloured male from the Isle of Wight from the Meldola Collection. In a very remarkable specimen from the Spilsbury Collection, the black border is prolonged to the discal spot in the costal part of the fore wing, and the usual pale marks in the black area are reduced to three small dots in the upper half and a small spot towards the inner angle.

C. edusa.—A long series of upwards of 120, including 24 ab. *helice.* A female taken in Oxford, by Mr. A. H. Hamm, has a very large discal spot, thus approaching the Himalayan *C. fieldii.* A fine lemon-coloured male, taken at Sidmouth in 1872, was presented to the collection by Prof. Poulton. In some of the females the spots in the marginal black area are greatly reduced in size, and in one the spots are practically obsolete.

Gonepteryx rhamni.—A long series without many aberrations. A fine gynandromorph, in which the male colour predominates, has the female coloration in the whole of the left fore wing except the costal portion and in the lower portion of the right hind wing. It was taken near Reading about 1873; presented to the collection by Prof. Poulton. In a short series from the Champion Collection three males have the undersides of a buff colour instead of the normal greenish, while the uppersides are of the usual sulphur colour. Two of the females have the undersides pale buff with upper sides cream-coloured. They were all taken or bred at Woking about 1912. There is also a cream-coloured female with pale buff underside bred at Oxford, August 9th, 1918, by Mr. A. H. Hamm.

NYMPHALIDÆ.

Apaturinæ.

Apatura iris.—A fine series of 34—19 males, 15 females, all but one in perfect condition. Eighteen have full data. Of these 14 are from the New Forest, from the Chitty, Sellon and Meldola Collections. Four are bred from larvæ found near Oxford by Mr. J. Collins. The remainder, which are without data, are from the older Hope and Spilsbury Collections.

Nymphalinæ.

Limenitis sibylla.—A series of 58, mostly from the New Forest, but 11 from Berks, 7 from Surrey and 2 from near Oxford. All

are normal except one ab. *nigrina* from the Spilsbury Collection and one intermediate with a portion of the white band clouded with black, from near Reading, taken July 17th, 1919, by the Rev. C. F. Thornewill.

Polygonia c-album.—Series of over 80, without any very remarkable aberrations. There are 7 ab. *hutchinsoni* from Leominster. Much variation is shown in the undersides, from an almost unicolorous very dark brown to the light, well-marked pale brown of ab. *hutchinsoni.*

Eugonia polychloros.—Series of more than 50, with no extreme aberration. A very large specimen from the Champion Collection, taken in the Isle of Wight, August 6th, 1909, has a rather broad black margin to the hind wings adjoining the blue lunules, which are very large and bright.

Aglais urticæ.—Upwards of 120 with several remarkable aberrations. The most striking is one from the Spilsbury Collection with no data. The whole of the ground-colour is creamy-white. A very perfect ab. *ichnusoides* almost exactly corresponding to the figure in Seitz was taken wild in N. Staffs, July 30th, 1918. In another ab. *ichnusoides* taken at Parsonstown, in Ireland, by the Hon. G. L. Parsons, in August, 1886, the black spot of the inner margin is greatly enlarged and prolonged towards the inner angle of the fore wings and the outer portion of the wing is much suffused with a dark shade, thus greatly reducing the red ground-colour. Another remarkable specimen of the same type has the outer margin of the fore wings of what can only be described as a pale mud-colour. It is from the Hope Collection, and is labelled "S. Wales, St. David's, 1876." In two specimens taken wild on two successive days in a garden in the town of Market Drayton, by Mr. H. G. F. Onions, the ground-colour is of a pale ochreous brown, as are also the usually yellow spaces between the black costal spots. A series of five very similar specimens, but with the yellow spaces of the normal colour, was bred by Mr. P. Tautz from larvæ found at Chorley Wood, Rickmansworth, in 1914. Possibly the pupæ of these, as well as the pupæ of the specimens of *V. io* referred to further on, were subjected to abnormal conditions, but the labels attached make no mention of such

being the case. Two specimens from Herts, one from Bute and one from Kincardine, make approaches towards the subspecies *A. polaris*, Stgr. From Morthoe, N. Devon, a fine specimen, taken by Dr. F. A. Dixey, F.R.S., August 25th, 1892, very closely approaches the Japanese form ab. *connexa*, Btlr., but there are faint indications of blue spots at the margin of the fore wing.

Vanessa io.—Series of 80, from many English localities and two from Tyrone, with few aberrations. One very remarkable one was taken in the Museum grounds in 1878. The fore wings are normal except that the yellow portion of the interior edge of the ocellus is much reduced in size and the space between the black costal spots is dull ochreous. In the hind wings the normal blue and black centre of the ocellus is reduced to a small black spot set in the middle of a circular patch of very pale ochreous colour. In a series of 10 bred from larvæ found in Chorley Wood, Rickmansworth, Herts, in 1914, by Mr. P. Tautz, the typical red is replaced by a dull maroon or madder-purple colour. The two specimens from Tyrone have a black spot below, but touching, vein 2 in the inner discal portion of the fore wings.

Euvanessa antiopa.—Fifteen specimen. Three from the Hope Collection, and one from Spilsbury Collection, all unlabelled. Another from the Spilsbury Collection is labelled "Bred by the late Mr. Kirby [author of an 'Introduction to Natural History'], given to me by Mr. Dummitt, of Uttoxeter." Another also from the Spilsbury Collection is labelled "Caught by — Farrell, near Macclesfield, September, 1858." A specimen in splendid condition was taken by the Rev. J. W. B. Bell on a sugared post at Pyrton, Oxon. This specimen was recorded in the 'Entomologist,' 1900, p. 250. Two specimens taken at Cromer in late August or early September, 1872, by Miss M. C. and Miss E. H. Lowe, were presented to the collection by Prof. Poulton. A hibernated specimen taken by a boy at Mapledurham in the spring of 1873 was presented to the Collection by Prof. Poulton. A very fine and perfect specimen from the Chitty Collection is labelled "New Forest, 11/6/92." Another from the same collection is labelled "New Forest, 10/8/88. 'Entomologist,' vol. xxi, page 229." A specimen from the Meldola Collection labelled "G. Ruffel, Bigods, Sept. 20, 1900." One from the Sellon Collection, labelled "Worthing, 1879." Another from the same collection labelled "Salwey's Collection, originally from F. Standish's."

Pyrameis cardui.—Upwards of 70, with no noteworthy aberration.

P. atalanta.—No aberration, except one small but apparently very rare, consisting in the absence of the lowest of the normal five subapical spots. It was bred in the New Forest by C. Gulliver, October, 1912.

Argynnis paphia.—Upwards of 80 specimens, including 39 ab. *valesina*, with otherwise no noteworthy aberrations.

A. cydippe.—Upwards of 60 specimens. A beautiful aberration in which the ground-colour is creamy-white, taken in S.W. Bucks by Miss L. B. Evetts, July, 1896.

A. aglaia.—A fine series of more than 80, with much slight variation in the females, some being very dark.

Issoria lathonia.—Eleven specimens. Four from the Hope Collection, each labelled "Wells British Collection." Four from the Spilsbury, without any data. One from the Sellon Collection labelled by Mr. Sellon "Salwey's Collection." Another label, apparently Salwey's original label, has on it, "Folkestone, 1868, presented by T. Briggs, Esq." Two other specimens are labelled "O.E.S." (Oxford Entomological Society).

Brenthis euphrosyne.—Series of 90 specimens. A fine aberration from the Hope Collection without data has the interior portion of all the wings blackish, this coloration extending nearly to the transverse row of submarginal spots. The rest of the wings is much suffused with black. An underside taken May 29th, 1916, near Abingdon, Berks, by the Rev. C. F. Thornewill, entirely wants the normal reddish markings, and the ground-colour is of a very pale ochreous. A specimen of that very rare occurrence, a second brood, taken August, 1899, near Reading, by Mr. W. Holland, is in perfect condition and much below the normal size.

B. selene.—Series of over 100. A fine aberration taken June 11th, 1913, at Crowthorne, Berks, by the Rev. C. F. Thornewill, has a broadish black band in the outer portion of the fore wing along the margin. All the wings are also much suffused with black. A series of 11 specimens of a second brood from the Pogson-Smith Collection was taken near Oxford, August 8th, 1911. They are in perfect condition and much smaller and paler than normal first-brood specimens. Another specimen of the second brood from the Chitty Collection was taken at Dodington, Kent, in August, 1895.

Melitæa cinxia.—Series of 60. One specimen from the Spilsbury Collection, without data, has the row of spots in the central pale band on the underside of the hind wing very large and some of them converted into streaks.

M. athalia.—Series of 63. Mostly from Kent and Sussex, with no remarkable aberration.

M. aurinia.—Series of upwards of 130 from many English localities, six Scottish and one Irish specimen. The series is interesting in showing the slight variation between the series taken in different localities, but there are no very striking aberrations. In a specimen from the Meldola Collection taken at Ivybridge, June 23rd, 1889, and in another without data from the Sellon Collection, the paler ochreous markings are

absent and the whole ground-colour of the wings is tawny fulvous. The series of six from Scotland, bred from Oban larvæ, May, 1913, presented by Mr. A. Horne, has the pale markings of a cream colour, giving the series a very striking appearance.

Satyrinæ.

Melanargia galatea.—Series of upwards of 90. No very remarkable but several minor aberrations. In two specimens from Kent, both females, and one from Northants, a male, on the upper side the outer black band in the hind wing is almost obsolete, only the ocelli being left, which are thus rendered very conspicuous.

Erebia epiphron.—Thirty-eight English from Lake District, 13 from Perthshire, 20 without data. From the Meldola Collection is a specimen labelled "Lake District," but without date, of a unicolorous dark brown = ab. *obsoleta*, Tutt.

E. æthiops.—Series of 24 English, 50 Scotch, 10 without data. No very striking aberration.

Hipparchia semele.—Series of 100. Much variation of a minor character, but none very remarkable.

Pararge ægeria.—Series of upwards of 70.

P. megæra.—Upwards of 60.

Epinephele jurtina.—Series of upwards of 100, with several striking aberrations. Two females, one from the Meldola Collection, taken in the New Forest, the other from the Pogson-Smith Collection, taken at Nettlebed, Oxon, have the fulvous subapical blotch on the fore wing white instead of the usual fulvous. A very remarkable female taken September 1st, 1891, by Mr. W. Holland, has nearly the whole of the right fore wing bleached, but retains in the bleached portion traces of the fulvous subapical blotch of the normal colour. In the left fore wing only the apex is bleached. In both the ocellus is reduced to a white spot surrounded by a very narrow ring of black. On the right hind wing is an oblique bleached stripe from the middle of the costa to the anal angle. From the Meldola Collection is a very beautiful symmetrically bleached female taken near Romford, Essex, in July, 1895. Towards the apex of the fore wing is a large irregularly-shaped white blotch of similar size, shape and position, on each wing. Both hind wings have the central portion of the wing bleached, with a narrow margin of normal colour running completely round the wing. There are seven other specimens with partial bleaching of the wings.

Epinephele tithonus.—Series of 70. Six specimens have supernumerary black spots on the fore wings. One from the Chitty Collection, labelled "New Forest, 1890," has the outer margin of the right fore wing bleached, and the central dark

band is almost obsolete. The left fore wing is normal except that the outer marginal band is very light brown. From the Champion Collection, labelled "Woking," is a remarkably dwarfed male.

Aphantopus hyperanthus.—Series of 95. Two undersides, one from near Bude, the other from the New Forest, are asymmetrical on the undersides, having three ocelli on one fore wing and only two on the other. A fine specimen of ab. *arete*, Müll., was taken by Mr. F. A. Dixey in Darenth Wood, July 17th, 1876. Two other specimens of ab. *arete*, one from the Hope, the other from the Spilsbury Collection, are without data.

Cœnonympha tiphon.—A series of over 50 Scotch specimens and 54 English = ab. *rothliebii*, with 18 unlabelled, mostly English, from the Hope and Spilsbury Collections. The English specimens show a very great range of variation of the size of the ocelli on the underside.

C. pamphilus.—Series of over 80, with no remarkable aberration.

Nemeobius lucina.—Series of 80.

LYCÆNIDÆ.

Zephyrus betulæ.—A long and fine series chiefly from Devon, Hants and Oxford, in all about 80, with only one remarkable aberration. This is a male specimen from the Spilsbury Collection in which the white line on underside of the fore wing is entirely wanting, as is also the outer white line of the hind wing. It has no data.

Z. quercus.—A fine series of upwards of 60, mostly bred chiefly from Devon, Hants and the New Forest. There are two indications of aberration, and both seem to be pathological. One is a ♂ bred by myself in the New Forest, and the other, unlabelled, from the Meldola Collection. In both the aberration is in one of the hind wings. A large proportion of the normally blue scales are white, giving a rubbed appearance, but a lens shows that this is not the case. In the New Forest specimen the aberration is on the right side, in the other on the left. In both specimens the shape of the affected wing is abnormal, the edge of the wing from the angle to the tail being straight instead of curved.

Thecla pruni.—Thirty specimens, labelled, from Northants, Huntingdon and Oxford. Twenty, unlabelled, from the Hope, Spilsbury and other Collections.

T. w-album.—A series of 45. Thirty, with data, from several localities.

Callophrys rubi.—A long series of upwards of 100. One underside from Cumberland, with a row of white spots in the fore as well as in the hind wings. Another has the underside altogether spotless; this is from Cornwall.

Chrysophanus dispar.—A very fine series of 27—14 male, 13 female. Most of them are in perfect condition, even with respect to antennæ. With them are two ichneumons, labelled by Prof. Westwood as "ichneumons of *C. dispar.*" The species has not yet been determined.

C. virgaureæ.—A specimen, not in very good condition, from the Hope Collection, is the one referred to in Humphreys

and Westwood's edition, 1841, p. 98, and has a label to that effect by Prof. Westwood: "I possess a specimen given me by the late Mr. Haworth as an undoubted native specimen."

C. phlæas.—A fine varied series of upwards of 150 from many localities. The chief aberrations are two ab. *alba*, Tutt, one taken near Oxford by Mr. W. Holland, the other from N. Staffs taken by myself. An ab. *eleus*, unlabelled, from the Spilsbury Collection, and another ab. *eleus*, from the Champion Collection, labelled "Milford, Surrey, July 29th, 1908." A very remarkable ab. *suffusa*, Tutt, taken in N. Staffs by Mr. H. E. F. Onions, August 5th, 1918. In this specimen the normal bright red of the fore wing is replaced by a pale buff colour along a narrow subcostal strip embracing the discal spots. The rest of the wing is deeply suffused with dark fuscous. In the hind wing the usual red band is buff coloured and much reduced in length and breadth. A very similar specimen, except that the ground-colour is more normal, was taken in the same locality, 1917, by myself. A fine ab. *radiata*, Tutt, Woking, August 13th, 1912, is from the Champion Collection, as is also a very fine ab. *juncta*, Tutt, taken near Woking. It approaches ab. *kochi*, two of the upper spots of the transverse set being elongated. There are also in the series several specimens of ab. *magnipuncta*, Tutt, ab. *parvipuncta*, Tutt, and ab. *intermedia*, Tutt, from various localities.

Plebeius ægon.—A long series of upwards of 100, but with very few aberrations. A series of 12 ab. *masseyi*, Tutt, from Witherslack. A remarkably dwarfed female specimen from the Meldola Collection, taken in Surrey, is no larger than a normal *Cupido minimus.*

Aricia medon.—A long series embracing all three forms—*medon*, *salmacis* and *artaxerxes.* One ab. *artaxerxes* is labelled "Durham, Castle Eden, capt. July 25th, 1893, by T. Maddison." In three specimens of ab. *artaxerxes* from Kincardine there is a black spot in the subterminal row of ocelli of the fore wing.

Polyommatus icarus.—A series of upwards of 190 from many English localities and from Scotland and Ireland. There are two ab. *icarinus* and three others closely approximating to that form. A remarkable pale lilac male, ab. *pallida* Tutt., from the Sellon Collection, is labelled "Grut's Collection." Two females are entirely blue except at the outer margins. Other female aberrations are too numerous for description.

Agriades bellargus.—A series of 67, all normal.

A. corydon.—A long series of upwards of 150. Two ab. *syngrapha* from Princes Risboro', 1917, taken by L. W. Newman. Ten *semi-syngrapha* taken at Royston, 1917. One ab. *corydonis*, Bergst., Princes Risboro'. Two female undersides, ab. *obsoleta*, also from Princes Risboro'. Another female ab. *obsoleta*, taken by Prof. Poulton near Reading about 1893. The above are the principal aberrations.

Celastrina argiolus.—A long series of upwards of 100, well illustrating the season dimorphism. The aberrations are few except in the size and number of spots on the underside, but there are two pinkish lilac males, ab. *lilacina*, Tutt, unlabelled, from the Spilsbury Collection. Also a female ab. *lilacina* from the Meldola Collection, but the usual black borders are light brown. Taken at Deal, August, 1901. A very remarkable male underside was taken by myself in the New Forest May 8th; 1915. The fore wings are spotless except for the central lunule, which is very faint, but in the hind wings the spots of the marginal row are elongated into streaks. In Tutt's 'British Lepidoptera,' vol. ix, pl. xviii, fig. 10, exactly represents the hind wings of this specimen, but has also the fore wings with spots and streaks. It is named *subtus-radiata*, Obth. This specimen might be described as ab. *subtus-partim-radiata*. A very minute female, smaller than many specimens of *C. minimus*, was taken by Prof. Poulton, August 6th, 1896, at St. Helens, Isle of Wight.

Cupido minimus.—A series of upward of 70 without any noteworthy aberration.

Nomiades semiargus.—A series of 12, most in very good condition, 5 from the Hope Collection, 4 from the Spilsbury, and 3 labelled "Grut's Collection" from the Sellon Collection.

Lycæna arion.—A series of 119. Twenty-nine from the Bude District, taken by myself, 41 also from the Bude District, taken by Mr. B. G. Adams, 29 from the Cotswolds in the Pogson Smith Collection. The rest without data. Except in the number and size of the spots the aberration is small. A male in the Pogson Smith Collection has only two submedian spots in the fore wings, and no spots in the hind wings. Of the small race there are 4 from Bude (2 males, 2 females), 3 from the Cotswolds (2 males, 1 female), 3 from the Hope Collection and 1 from the Spilsbury, the last 4 being all males.

HESPERIIDÆ.

Hesperia malvæ.—Series of upwards of 80. One specimen from the Sellon Collection labelled "Winchester" has an unspotted hind wing. Fourteen specimens exhibit every degree of modification from the type to the fully developed ab. *taras*. Of the remaining species of the Hesperiidæ it need only be stated that all are well represented in the normal forms.

ADLARD AND SON AND WEST NEWMAN, LTD., IMPR., LONDON AND DORKING.

Reprinted from 'The Entomologist,' Vol. LIII, November, 1920, and Vol. LIV, January, 1921.

SOME NOTES ON THE COLLECTION OF BRITISH MACRO-LEPIDOPTERA IN THE HOPE DEPARTMENT OF THE OXFORD UNIVERSITY MUSEUM.

By F. C. Woodforde, B.A., F.E.S.

SPHINGIDÆ.

Dilina (*Mimas*) (*Smerinthus*) *tiliæ*.—Series of over 70, showing a great range of variation both in marking and coloration. In marking the variation lies chiefly in the central dark marks in the centre of the fore wing. In some specimens these are united to form an unbroken band, in others this band is broken up into three separate blotches, in others reduced to two, and in a few to one blotch, this lying in the central portion of the wing. Four specimens are asymmetric in marking. The coloration ranges from a greyish pink to almost white in the ground-colour of the central portion of the fore wing in the males, and over many shades of red-brown in the same part of the wing in the females. In two males from Reading, one taken wild, one bred in 1894, the ground-colour is almost white.

Smerinthus (*Amorpha*) *populi*.—A very fine varied series of 60. A remarkable series of 8 was bred by Mr. A. H. Hanm in 1900 from ova deposited by a female which was brought to the Museum in June. The larvæ fed up very quickly, and the moths emerged as a second brood between July 25th and July 30th. They are small. Six are of a very pale whitish-grey colour, with very faint markings. Two are almost unicolorous pale buff.

S. ocellatus.—A series of 42 without any remarkable aberration. There are 5 hybrids, *populi-ocellatus*. One is from the Hope Collection, two from the Spilsbury, all three without data. Two were bred in Kent by Mr. J. W. Newman in 1917,

the male parent *S. populi*, the female parent *S. ocellatus*. All five are remarkably similar in colour and marking.

Acherontia (*Manduca*) *atropos*.—A fine series of 22, with full data.

Sphinx convolvuli.—Series of 29.

S. pinastri.—Three specimens, one from the Hope Collection, rather worn, without data, two from the Chitty Collection, labelled "*Ex* Coll. Haslehurst."

Phryxus (*Deilephila*) *livornica*.—Five specimens, one from the Spilsbury Collection, labelled "From Coll: of late Hugh Harrison of Bowden. Said to have been taken near Manchester, bought by me through Mr. Hodgkinson fr: Mr. Brockhoules' Coll: 1875. F.M.S." One from Reading, taken July 24th, 1870, by Prof. Poulton. One from the Sellon Collection, labelled "Fr: Burnell's Coll: This specimen was caught at Fifield, Berkshire, June 1884 by Mr. Micklem." One from the Meldola Collection, labelled "Dorset 1906. Canford Cliffs. June 4. 1906." One from the Spilsbury Collection, without data.

Hippotion (*Chærocampa*) *celerio*.—Four specimens. One from the Spilsbury Collection, labelled "Taken at Wakefield. fr: Coll: of Mr. Harrison, next of Mr. Brockhoules', thro' Mr. Hodgkinson." It is in perfect condition. One from the Meldola Collection, labelled, "In house: Hurstpierpoint, Sussex. Sept. 12th 1885. Given to Wm. Mitten and by latter to W. G. Wallace 1885. To R. Meldola from latter in 1914. (Jan. 11th)." In perfect condition. One from the Hope Collection—a mere fragment—without data. Another specimen from the Spilsbury Collection; much damaged.

Deilephila euphorbiæ.—Four specimens. Two from the Hope Collection, one of them being labelled "Wells Coll." Two from the Spilsbury Collection, one of them labelled "*Euphorbiæ* fr: coll: of Mr. Harrison, bt: fr: late Peter Bouchard Esq. who had it fr: Coastguard's man. Then in Colln: of Mr. Brockhoules, bt: by Mr. Hodgkinson fr: him."

D. galii.—Eleven specimens. Three from the Hope Collection, labelled "Wells Brit. Coll." Two from the Spilsbury Collection without data. Three from the Sellon Collection, labelled "Vaughan's Coll." On one a further label has "S. J. Capper. 1876." A fourth specimen from the Sellon Collection is labelled "Bennett's Coll." and a fifth "Burnell's Coll."

Daphnis (*Chærocampa*) *nerii*.—Two specimens. One from the Hope Collection, a female, very old and faded, but otherwise perfect. One from the Chitty Collection, both without data.

Metopsilus (*Chærocampa*) *porcellus* and *Chærocampa elpenor*.—Long series of each species, but without any noteworthy aberration.

Macroglossa stellatarum.—Long series. Two from Chitty Collection, with dark brown hind wings, with no data.

Hemaris fuciformis and *tityus*.—Long series without aberration. Three specimens of *fuciformis*, freshly emerged, show many scales on the wings.

Dicranura bicuspis.—Series of 25. Nine from Tilgate Forest, Sussex, 9 from North Staffs. taken by myself, 1 from Shifnal, Salop, 5 unlabelled from Spilsbury Collection, 1 unlabelled from Hope Collection.

Stauropus fagi.—Series of 31. Five specimens taken in 1892 were originally melanic, but are now faded to very dark brown. This also applies to a remarkably fine female labelled "Marlow," bred by the late Canon Barnard Smith.

Drymonia trimacula and *chaonia*.—Fine series of both species. One specimen of the latter from the Pogson Smith Collection, bred from a larva taken in Bagley Wood, has the central band entirely filled up with the dark ground-colour, and the white lines bounding it are very indistinct.

Notodonta phœbe = *tritophus*.—There are two specimens without data from the Hope Collection. Both are in perfect condition.

Lophopteryx cuculla.—Series of 16. Ten labelled "Marlow," eight of which are from the Sellon Collection.

Odontosia carmelita.—Series of 17. Seven from the Sellon Collection, labelled "Sussex." One from the Champion Collection, bred April 17th, 1910, from a larva taken at Chobham in September, 1909.

Ptilophora plumigera.—Series of 27. Only six with data, three of which are from Bucks, three from Kent.

THYATIRIDÆ.

Palimpsestis duplaris.—A long series from various localities. Eleven melanic specimens from Staffs.

Polyploca ridens.—A specimen without data from the Spilsbury Collection has the basal and outer portions of the fore wing white.

LYMANTRIIDAE.

Lælia cœnosa.—Series of 35 from various collections. One female from the Meldola is labelled "Burwell Fen. Dr. W. Horley."

Ocneria dispar.—A long series from the Hope and Spilsbury and more modern collections, some of them apparently of great age. Three males from the Spilsbury Collection have the inner and central portions of the fore wing nearly filled with whitish, with a dark narrow band along the outer margin. A small, seemingly very old male has all the wings of a dingy white.

Lymantria monacha.—A series of 6, bred by Mr. C. Rippon from New Forest parents, have the abdomen banded with pale yellow instead of the normal pink. The fore wings are suffused with black to an abnormal extent.

LASIOCAMPIDÆ.

Pachygastria trifolii.—Two specimens from the Hope Collection came from F. Bond's Collection. They were bred in August, 1871, from larvæ taken in Romney Marsh, Kent. They are described in the 'Proceedings of the Entomological Society,' November 20th, 1871. They are very pale brown on the inner portion of the fore wings, the outer portion being ochreous.

Lasiocampa quercus.—A very remarkable specimen from the Hope Collection, which has the body and wings of a female with male antennæ, also came from F. Bond. It is labelled "May, 1867, larva found in the London District." On another label is "Mr. F. Bond."

Macrothylacia rubi.—In a male specimen from the Hope Collection the two pale lines are widened and drawn close together, making a pale band, only showing indications of the dark inner band at the costa and inner margin. In two other specimens taken by myself in North Staffs by assembling, and in one from the Meldola Collection from Morpeth, the two pale lines are much nearer to each other than is normal. In two others, one bred by myself from a New Forest larva, the other from the Chitty Collection, also from the New Forest, the inner pale line is obsolete.

Gastropacha ilicifolia.—Two specimens from the Spilsbury Collection without data. One from the Sellon Collection, labelled "Cannock Chase by Orgill of Rugeley." It is rather faded and the antennæ are wanting, but is otherwise in very fair condition.

DREPANIDÆ.

Drepana falcataria.—Five ab. *pallida*, White.

D. harpagula = sicula.—Six specimens, four presented by Mr. G. C. Griffiths, bred by him from larvæ beaten in the Leigh Woods, Bristol, 1895, 1896 and 1899. One from the Meldola Collection, labelled "Leigh Woods, Bristol bred 6. 1899." One from the Sellon Collection, without data.

D. lacertinaria.—Several ab. *scincula*, one of them from the Hope Collection being a Haworth specimen and labelled by him "*scincula.*"

NOLIDÆ.

Nola strigula.—Six from the Sellon Collection, New Forest; 5 from the Meldola Collection; 4 from Sussex, Abbot's Wood; 1 Kent, Darenth Wood; 1 from the Pogson Smith Collection, labelled "Oxford district, July 1897."

N. confusalis.—Two specimens of ab. *columbina*, Selwyn Image, from Epping Forest. One of them is one of the two specimens exhibited at a meeting of the Entomological Society, June

6th, 1906, and reported in the 'Proceedings of the Entomological Society' of the same date. The other is from the Meldola Collection, taken in Epping Forest, May 30th, 1908. This variety was first described in the 'Entomological Record,' vol. xvii, p. 188.

N. albulalis.—Long series, but only eight specimens with data. These are from the Meldola Collection, labelled "Kent. Chattenden," without date.

N. centonalis.—Eight specimens. One from the Meldola Collection, labelled "Deal. 1881/3. Rt. Adkin." One specimen in each series of *N. cuculatella*, *strigula* and *confusalis* are Haworth specimens, and each is labelled with its name in his writing.

N.B.—Haworth's specimens are recognisable by a special label.

SARROTHRIPINÆ.

Sarrothripa revayana.—Series of over 100, including almost every possible variation. By far the greater number are from the New Forest. By the kindness of Mr. South several of the forms have been identified and named.

ARCTIIDÆ.

Spilosoma menthastri.—In a long series from Perthshire, bred and presented by Mr. T. M. Marshall, the fore wings are of varying shades of pale buff. From the Meldola Collection is a very dark buff form from Glasgow. A female from North Staffs, bred by myself last year, is asymmetric, the right fore wing having less than half the number of spots that there are on the left. The right hind wing has only one very small submarginal spot, while the left has two. In both hind wings the central spot is obsolete. From the Hope Collection is one of Haworth's specimens, labelled by him *S. lubricipeda.* The series contains 14 ab. *radiata* and 9 ab. *zatima.*

Diaphora mendica.—Six specimens bred by Mr. L. W. Newman are six hybrids, between the type and ab. *rustica.* The males are pale greyish-buff. In a series of 16 bred from ova obtained by me from Mr. L. W. Newman in 1916, together with the two parents, the males, except one, which is rather pale buff, are of true *rustica* type. From two of this brood another generation of 17 specimens was reared. The male parent was of the true *rustica* type, but 3 of the male offspring resembled the hybrid males alluded to above, the 6 other males being true *rustica.*

Phragmatobia fuliginosa.—In 3 females from the Champion Collection, bred from larvæ taken near Woking, and a female from the Meldola Collection, taken in North Cornwall, the fore wings are dark and the hind wings show only a very narrow red border along the inner margin, and closely resemble var. *borealis.*

A series of 6 var. *borealis* from Aberdeenshire was presented by Mr. A. Horne.

Parasemia plantaginis.—In a striking series of 18, taken wild near Cerne Abbas, Dorset, by Dr. R. C. L. Perkin, and presented by him, the paler markings predominate over the black. This is particularly noticeable in the females, five of which have remarkably small proportion of black in the fore wings. A specimen from the Sellon Collection has a female body and markings, but the right antenna is female and the right male. It is labelled "Hermaphrodite (Harwood)."

Diacrisia sanio.—A male taken in N. Staffs by myself in 1917 is almost entirely wanting in the black border of the hind wings, this being slightly indicated by a few greyish scales. A female taken in the same locality has almost the whole of the hind wing filled with black, only two small rufous spots being left.

Arctia caia.—A long series showing a great deal of minor variation. There is one very remarkable aberration of a female from the Spilsbury Collection. Except for a few very small white spots which do not correspond with each other on each side the whole of the forewings are filled up with very dark brown. On this dark brown ground are black markings exactly corresponding with the usual white markings of a normal specimen. The hind wings have a very broad blue-black border, with a broad dark central band. From the Hope Collection is a female with normal markings, but with lemon-coloured hind wings.

Callimorpha dominula.—One from the Chitty Collection taken in S. Devon has the two spots near the anal angle of the hind wings coalescent, with much blackish suffusion towards the centre of the wing, resembling a smudged ink-blot. A series of 10 fine bred ab. *rossica* from Kentish stock (from L. W. Newman).

Coscinia striata.—Two specimens, both from the Hope Collection. One of them has a label "Wells Brit. Coll." Neither of them is in perfect condition.

C. cribrum.—Varied series of over 60, mostly from Ringwood. Six from the Meldola Collection, labelled "Canford, Dorset."

Deiopeia pulchella.—Six specimens. One from the Sellon Collection, on an old common pin, labelled "Standen's Collection"; another label, apparently Standen's, has on it "Taken by Dr. Battersby at Torquay." A second from the Sellon Collection has a label "Folkestone, –/8/84 taken by V. R. Prince." Two from the Spilsbury Collection, one labelled "from Mr. Brockhoules' Collection, Westmoreland, bred by the Revd. — Tristram. ♀ caught at Torquay, which laid 14 eggs. From Mr. Hodgkinson." Two from the Hope Collection with no data.

Hipocrita jacobææ.—Two specimens have yellow hind wings and a yellow stripe and spots on the fore wing. One is from the Hope Collection. The other from near Southampton, taken about 1889 by the Rev. G. Hughes.

Cybosia mesomella.—A male and two females from the Hope Collection are Haworth specimens. The male has yellow fore wings, and is labelled by him "*eborina.*" One of the females is labelled, also by him, "*flavescens.*"

Lithosia deplana.—A fairly long series with considerable variation. A very large female from the Sellon Collection, taken in the New Forest, and another from the Meldola Collection taken at Horley, Surrey, have very dark greyish-brown fore wings with a strong dark yellow stripe along the costa extending to the apex, the hind wings being darkish grey. Two females from the Meldola Collection taken at Boxhill have rather bright yellow forewings (resembling pale specimens of *L. sororcula*) with paler hind wings. From the Hope Collection is a Haworth specimen labelled by him "*helvola.*"

L. griseola.—A Haworth specimen is labelled by him "*ochreola.*"

L. griseola, ab. *flava.*—There are two Haworth specimens, one of which is labelled by him "*flava, F.*"

Lithosia sericea.—Six specimens from Warrington. Four others from Chitty and Sellon Collections, unlabelled.

L. caniola.—A long series from S. Devon. One pure white = ab. *lacteola*, Boisd., a female, was taken by myself last August near Paignton. From the Meldola Collection are three specimens labelled "Romney Marsh 1895."

Lithosia sororcula.—A Haworth specimen labelled by him "*Aurantina.* Pr."

Pelosia muscerda.—Two of the specimens from the Meldola Collection are labelled, one "Eastry, Kent, 1903," the other "Kent 1907."

ADLARD AND SON AND WEST NEWMAN, LTD., IMPR., LONDON AND DORKING.

230

Reprinted from 'The Entomologist,' Vol. LIV, April, June and July, 1921.

SOME NOTES ON THE COLLECTION OF BRITISH MACRO-LEPIDOPTERA IN THE HOPE DEPARTMENT OF THE OXFORD UNIVERSITY MUSEUM.

By F. C. Woodforde, B.A., F.E.S.

NOCTUIDÆ.

Acronyctinæ.

Acronycta leporina.—A long series of ab. *bradyporina*, Tr., from various localities. A very dark specimen ab. *melanocephala*.

Mansbridge, from North Staffs. There are three specimens without data of true *leporina*, one from the Hope and two from the Spilsbury Collections.

A. aceris.—A specimen of ab. *infuscata*, Haw., from the Spilsbury Collection, without data.

A. alni.—Series of 25, 13 of them with data. One from the Hope Collection is labelled with a reference to the 'Entomologist Intelligencer' of 1856, p. 108. Three N. Staffs bred specimens show a decided tendency towards melanism.

A. strigosa.—Series of 22. Two are labelled "Cambridge Fens, July, 1890, presented by W. Holland." Another from the Meldola Collection is labelled "Cambridge," but without a date.

A. auricoma.—Six specimens. One from the Meldola Collection is labelled "Sussex, 1894."

A. rumicis.—Two specimens of ab. *salicis* from N. Staffs, and one from Yorks from the Sellon Collection.

A. ligustri.—Series of upwards of 30, mostly with full data. Three ab. *coronula* taken near Oxford, from the Pogson Smith Collection, and one without data from the Hope Collection.

Arsilonche albovenosa.—Nineteen specimens. Six labelled "Cambridge." The rest without any data.

Bryophila perla.—Series of more than 100 with full data, among them a very beautiful yellow specimen taken in the Isle of Wight by the late Capt. R. W. Poulton. A series of more than 20 from the Meldola Collection, from various parts of Scotland, are larger and more strongly marked than the average of English specimens.

B. muralis.—A long and very varied series with full data from S. Devon, Wiltshire, Isle of Wight and Sussex.

B. impar.—Six specimens from Cambridge presented by Mr. J. Peed.

TRIFINÆ.

Agrotis segetum.—A long series with some fine aberrations.

A. vestigialis.—In the series are eight specimens taken near Oxford, at an inland locality in which it regularly occurs. They differ slightly from the type.

A. cinerea.—A very varied series of about 40, all but one males. Two specimens from Wyre Forest have a brownish ground colour.

A. cursoria, A. nigricans, A. tritici, A. aquilina, A. exclamationis, A. upsilon, A. ripæ.—Long series of each of these species exhibiting almost every form of variation.

A. obelisca.—Series of 40 from Devon, Isle of Wight and Purbeck.

A. præcox.—Series of 34, 17 with data, from the Isle of Wight, Cheshire and Lancashire.

A. simulans.—Seventeen specimens. Six from the Meldola Collection with data, viz. 4 Aberdeen, 1 E. Lothian, 1 Portland. The others without data.

A. agathina.—Series of 50 from Somerset, Dorset, Hants, Surrey and Carnarvonshire.

A. obscura.—About 30—6 Oxford, 3 Yorks, 3 Essex. The rest without data.

A. hyperborea.—A varied series with full data. Twenty-three from Rannoch, 1 from Shetland.

A. ashworthii.—Twenty-eight from Penmaenmawr with full data. Nine without data from the Hope and Spilsbury Collections. One of the Hope specimens is labelled "H. Doubleday."

Noctua subrosea.—Twelve specimens. Three or four of them are in bad condition; the rest more or less worn.

N. flammatra.—A specimen from the Sellon Collection labelled "Cummings Collection."

A. glareosa.—A long series from many localities in England and Scotland.

N. castanea.—A long series of grey and red forms, both English and Scotch. There are two specimens of a pale ochreous yellow approaching var. *xanthe*, Wdfde., both from the Burnt Woods, N. Staffs. One was presented to the Collection by the Rev. G. Hughes, the other by the Rev. C. F. Thornewill.

N. depuncta.—Fifteen specimens, but only three have data. One from near Reading, taken by Mr. W. Holland. Another from the Meldola Collection labelled "Exeter, 29 . 7 . 02." A third from Forres.

N. ditrapezium.—Twelve with data. Four of them from Brighton; the others from Scotch localities.

N. primulæ.—A long series from English localities. Twenty-nine var. *conflua* from Aberdeenshire, Ross-shire and Nairn. Two var. *thulei* from Shetland, presented by Commander J. J. Walker.

N. dahlii.—Series of 8 from the New Forest, 12 from N. Staffs, 22 from various Scotch localities.

N. sobrina.—Series of 20 from Aberdeenshire.

Triphæna orbona (*subsequa*).—Series of 30 with full data from Dorset, the New Forest and Canterbury.

T. comes.—A long series, including more than 20 of the dark Scotch forms. A remarkably fine specimen of var. *rufa*, Tutt, taken by myself in N. Staffs, is as dark as any Scotch example.

Eurois occulta.—Fifteen specimens from Scotland with full data. Two taken in Essex, August, 1869, from the Meldola Collection, are recorded in the 'Entomologist,' vol. iv, p. 325.

Aplecta tincta.—A fine series with full data, mostly from N. Staffs and Scotland.

A. nebulosa.—A long and very varied series. Eight ab. *robsoni*, 4 of which were presented to the Collection by Mr. B. H. Crabtree and 4 by Messrs. Main and Harrison. Four ab. *thompsoni* were also presented by Messrs. Main & Harrison and 1 by Mr. B. H. Crabtree.

§

Mamestra contigua.—Ten with full data from Surrey, from the Champion Collection. A very fine dark specimen labelled "Rannoch" from the Tautz Collection (bought at Stevens).

M. glauca.—Seven with full data from Staffordshire. Twenty from various Scotch localities; 6 of them, from Aberdeen, presented by Mr. A. Horne.

Dianthœcia barrettii.—A very varied series of over 50 with full data. Of these 23 were bred by myself from larvæ found in the Bude district on *Silene maritima*, and 16, also bred by myself, from larvæ found on *S. maritima* in S. Devon. Five specimens from S. Ireland bred by Mr. L. W. Newman. One of the Bude specimens has a distinctly ochreous tinge.

D. cœsia.—Series of 19, 12 with data, from Douglas, Isle of Man.

D. conspersa.—Series of over 50 from various localities in England, Wales and Scotland, with full data. Two specimens in a series of 10 bred from Carnarvonshire larvæ approach the dark Shetland form *hethlandica*, Staud., of which last there are 5.

D. albimacula.—Eighteen with data; 16 from Folkestone, 2 from S. Devon.

D. carpophaga.—A fairly long and varied series with full data. Twelve ab. *capsophila* from the Isle of Man.

Dianthœcia irregularis.—Five from Cambridge, presented by Mr. E. D. Bostock. Twelve from Suffolk, presented by Mr. B. H. Crabtree.

Hecatera chrysozona.—Nineteen specimens, but only one with full data. This is from the Meldola Collection, and labelled "On post, Darenth Wood, 12 . 7 . 73."

Neuria reticulata.—Series of 40, mostly from Dorset and Suffolk. The rest from various localities.

Pachetra leucophœa.—Series of 28 with data. All from Wye, Kent, except two labelled "Mickleham, Surrey, July 14, 1856."

Xylomyges conspicillaris.—Series of 20, mostly var. *melaleuca*, Vieweg. Fifteen labelled "Taunton." Two from the Chitty Collection labelled "Wales 1888." One from the Meldola Collection labelled "Worcester."

Eumichtis satura.—This rarity is represented by one specimen from the Sellon Collection labelled "*H. satura*, Oxford, Harper's Collection." It is possibly the specimen referred to in 'Barrett,' vol. iv, p. 113.

Crymodes exulis.—Six specimens, five with data. Three from the Meldola Collection are labelled "Rannoch." One, in poor condition, from the Sellon Collection, is also labelled "Rannoch." Another presented by Mr. J. Peed, by whom it was taken, is labelled "Unst. July 23–31, 1914."

Trifinæ.

Eremobia ochroleuca.—Series of 40, 26 of which have data. Twenty-five are from Kent and Essex. One from the Champion Collection is labelled " bred Guildford."

Trachea atriplicis.—Twenty-seven, most of them from the older collections and without data. Two from the Norgate Collection, presented by Mr. B. H. Crabtree, and three from the Meldola Collection are labelled " Cambridge."

Valeria oleagina.—A single specimen, slightly damaged, from the Hope Collection. This is probably the specimen taken July, 1800, by Mr. Donovan near Fishguard, in Pembrokeshire. See 'Barrett,' vol. iv, p. 330.

Luperina testacea.—From the Meldola Collection. Is a very dark brown specimen, almost black, in which usually markings are almost invisible. It is labelled " Lancs, St. Anne's-on-Sea, bred 17 . 8 . 12."

L. guenéei.—Over 40 with full data from St. Anne's-on-Sea.

L. dumerili.—A specimen from the Spilsbury Collection without data.

Hama abjecta.—Thirteen with full data from Hants, Kent and Essex.

H. furva.—Nineteen with data. A series of 7 from the Meldola Collection labelled "Surrey, Banstead, 7.04." The rest from Scotland.

Apamea pabulatricula (*connexa*).—Twenty-four, 4 with data. Three from the Sellon Collection labelled "Sheffield, 1890"; 1 from the Meldola, "Barnsley, 1890, Maddison."

A. ophiogrammea.—Nineteen with data from Surrey, Cambs, and Middlesex.

Aporophyla lutulenta.—Thirty-three with data. Two var. *luneburgensis* from Scotland. Two var. *sedi* without data from the Spilsbury Collection.

Polia xanthomista.—Twenty-four with data. Of these 2 are from N. Devon, taken by Dr. Dixey—one September 15th, 1890, recorded in the 'E. M. M.,' 1893, p. 87; the other September 28th, 1898. Of the rest 8 are from N. Cornwall; 14 from the Isle of Man; 6 presented by Mr. E. D. Bostock; 2 from the Meldola Collection; 6 from the Robertson Collection (bt. Stevens).

Trigonophora flammea.—Twenty-three, 10 of them with data. One from the Hope Collection is labelled "Bramber Castle." One from the Meldola Collection, "Sussex, Balcombe Wood, Octr. 24, 1871"; others from the same collection, "Sussex, Lewes." Four from the Champion Collection, "Sussex, 187?."

Hydrœcia lucens.—Twenty-three with data from Lancs, the Lake District and N. Staffs.

H. paludis.—Fourteen, all from the Meldola Collection; 8 labelled "Sussex, Bognor"; 4, "Kent, Deal"; 2, "Lancs, St. Anne's."

H. crinanensis.—Eight specimens. Two from the Meldola Collection labelled "Inverau, fr. L. W. Newman." Six from "Near Thursby, Carlisle, Aug., 1920, examined and certified by the Revd. C. R. N. Burrows." Presented by the Rev. H. D. and Mr. E. B. Ford.

Nonagria cannæ.—Twelve with full data, all from Norfolk.

N. sparganii.—Sixteen with full data. Three of them are from the Meldola Collection, one of them being the specimen taken in Deal in 1884, mentioned in 'Barrett,' vol. v, p. 83, and recorded in 'Entom.,' 1884, p. 253; and in 'E. M. M.,' 1884, p. 135.

Senta maritima.—Twenty-seven with data. Six from Whittlesea, presented by Mr. J. Peed. Eighteen from the Robertson Collection (bt. Stevens), which include 2 var. *bipunctata* and 2 var. *wismariensis*.

Tapinostola extrema.—Twelve with full data from Northants and Huntingdon.

Synia musculosa.—Two from the Spilsbury Collection without data.

Leucania favicolor.—Three specimens. One from Sheppey, presented by Commander J. J. Walker. Two from the Meldola Collection, labelled "N. Kent, 1911."

L. obsoleta.—Five with data. Three from the Meldola Collection, labelled "Ely." One from Whittlesea, presented by Mr. J. Peed. One from the Champion Collection, labelled "Ely."

L. brevilinea.—Twelve with data. Three v. *sinelinea*, Farn.

L. putrescens.—Twenty-one with data, all from Torquay.

L. unipuncta (*extranea*).—Two specimens. One from the Meldola Collection, labelled "Walmer, 1 . 9 . 78," recorded in 'E. M. M.,' 1878, p. 107, and mentioned in 'Barrett,' vol. v, p. 163. One taken by the Rev. G. Hughes in the New Forest, 8 . 10 . 96, recorded in 'Entom.,' 1896, p. 333.

L. vitellina.—Four with full data. Three from the Meldola Collection, taken in Sussex, and one from S. Devon.

L. albipuncta.—Eight with full data. Six from the Meldola Collection; 4 taken in Sussex, 2 in Kent, and 2 from S. Devon, taken by the Rev. G. Hughes.

L. turca.—A long series from the New Forest.

Caradrina exigua.—Seventeen with full data, most of them from S. Devon.

Acosmetia caliginosa.—Seventeen specimens, but only 4 with data, from the Meldola Collection, labelled "New Forest, 1877–78."

Pachnobia leucographa.—Twenty-one specimens, 6 with data, from Wales, Surrey and Yorks.

Tæniocampa gothica.—A long and very varied series, with full data, including several v. *gothicina* and intermediate forms.

T. incerta.—A long and interesting series. A very remarkable aberration from the Spilsbury Collection, without data.

T. opima.—Sixteen with full date. Five from Wyre Forest taken by myself. Four labelled "Lewes" from the Sellon Collection. Seven from the Meldola Collection, labelled "Lancs, St. Anne's-on-Sea."

T. gracilis.—A long series, including 40 specimens of var. *rufescens*, Cockerell, from the New Forest, bred by myself. These show a very great amount of variation in colour, from light greyish pink to very dark brown.

Dicycla oo.—Fifteen specimens with full data, including 5 var. *renago*, Haw.

Calymnia pyralina.—Thirty-seven with full data from S. Wales, Surrey and Middlesex.

Cosmia paleacea.—Five specimens with data. Four from the

Champion Collection, labelled "Sherwood Forest, 1872." One from the Meldola Collection, labelled "Ross-shire, Fortrose, 1903, found in a spider's web."

Plastenis retusa.—Sixteen specimens with data from various localities.

P. subtusa.—Twenty-one specimens with data.

Cirrhœdia xerampelina.—Four specimens with data. One from Cornwall, one from Oxford, one from Cambridge, and one labelled "Wales, 1888."

Ochria aurago.—A series of 40 with full data, showing much colour variation.

Mellinia ocellaris.—Five specimens with data. One from the Meldola Collection, labelled "Twickenham, Sept., 1893. 'Barrett,' vol. v, p. 397." The other 4 are also from the Thames Valley.

Orrhodia erythrocephala.—Three specimens, of which two are from the Spilsbury Collection with no data. The third from the Carden Collection (bt. Stevens, 1919), is labelled "Kemp-Welch Collection."

O. rubiginea.—Fifty specimens with full data, nearly all bred specimens, from various collections. One from the Meldola Collection is of an almost uniform brown without the usual irroration.

Lithophane semibrunnea.—Twenty-one with data. Ten from near Oxford, 4 from Cambridge, 3 from Hants, 4 from Surrey.

L. socia.—Over 30 specimens. One from Cornwall, 8 from Devon, the rest from Hants.

Graptolitha furcifera.—Two from the Spilsbury Collection. Four from the Sellon Collection in perfect condition. One, a rather worn specimen from the Chitty Collection, is labelled "Wales, 1888." Another specimen from the Norgate Collection, presented by Mr. B. H. Crabtree, is labelled "Wales."

Cucullia lychnitis.—Nine specimens with full data. Six from Berks, three from Surrey

C. asteris.—Six specimens with data from Surrey and Kent.

C. chamomillæ.—A long series with full data.

C. gnaphalii.—Two specimens without data from the Spilsbury Collection.

C. absinthia.—A long series from Devon and Portland.

Anarta cordigera.—Series of 16 with full data, all from Rannoch.

A. melanopa.—Nineteen with full data, also all from Rannoch.

Heliothis dipsacea.—Thirty-one with full data. Twenty from the New Forest taken by myself. Eight from the Champion Collection, "bred, Chobham, Surrey, 1913." Two from the Meldola Collection, "Maldon, Essex." In one of these last the

dark markings of the underwings, instead of being black, are a pale reddish brown.

H. peltigera.—Ten with full data, 7 from Torquay, 1 from the Isle of Wight, 1 from Bridgwater, 1 from the Sellon Collection, labelled "Sydenham, 6 . 88."

H. armigera.—Three with data. One from the Spilsbury Collection, in fine condition, labelled "Babbicombe, J. Terry, Octr., 1871." One from the Meldola Collection, "Torcross, 29 . 8 . 01." The third from the Sellon Collection, "Kent, Strood, 1878."

Thalpochares parva.—One specimen from the Sellon Collection, labelled "Dover, Cummings Collection."

Erastria venustula.—Twenty-eight with full data. Twenty from the Meldola Collection, "St. Leonards Forest, Sussex." Eight from Brentwood, Essex.

Emmelia trabealis.—Long series from Spilsbury, Chitty and Sellon Collections, but unfortunately all without data. One specimen from the Meldola Collection, labelled "Tuddenham."

Quadrifinæ.

Plusia chryson.—Twelve with data. One from Swansea, bred and presented by Mr. W. Holland; the rest from Cambridge.

P. bractea.—Two with data, "Kincardineshire, 1916," presented by Mr. Horne. A fine series of 8 from the Hope and Spilsbury Collections without data.

P. ni.—One specimen from the Meldola Collection, bred in 1906 from ova deposited by a ♀ caught near Tenby by Mr. J. A. Finzi, recorded in 'Entom.,' 1906, p. 212.

P. interrogationis.—Twenty-three with data. Six labelled "Keswick, 1896," the rest from various Scotch localities.

Catocala fraxini.—Four specimens. One from the Hope Collection, much worn and damaged, labelled "Wells' British Collection." One from the Spilsbury Collection, labelled "Whitby." A second from the Spilsbury Collection in good condition is without data. One bred, 1910, by Dr. R. Whitehouse, who presented it to the Collection, from an ovum deposited by a female captured at Horsham, 16 . 7 . 09, by A. James, of Tootham.

C. nupta.—In the long series is one remarkable specimen from the Champion Collection. The usual red bands of the hind wing are of a very dark maroon-brown colour (ab. *brunnescens*, Warren). It was taken on a lamp in Guildford, September 2nd, 1907.

Toxocampa craccæ.—Twenty-eight with full data. Twenty-six of these are from N. Cornwall. Two, from the Meldola Collection, are labelled "N. Devon."

HYPENINÆ.

Laspeyria flexula.—Twenty-eight with full data from Dorset, Hants, Oxford, Surrey and Essex.

Parascotia fuliginaria.—Two from the Spilsbury Collection without data.

Zanclognatha emortualis.—One specimen from the Spilsbury Collection, labelled "Loughton, 1870."

Madopa salicalis.—Five specimens, all without data. One from the Hope Collection, two from the Spilsbury, two from the Sellon. The last two have not been reset, and are set very low on very old twist-headed pins.

Herminia cribrumalis.—Twenty-four specimens. Four from the Meldola Collection, labelled "Wicken Fen."

H. derivalis.—Ten specimens with data. Nine from Colchester, one from Abbots Wood.

Hypenodes tænialis and *costæstrigalis.*—A fair series of each species with full data. The same may be said of *Tholomiges turfosalis.*

ADLARD AND SON AND WEST NEWMAN, LTD., IMPR., LONDON AND DORKING.

SOME NOTES ON THE COLLECTION OF BRITISH MACRO-LEPIDOPTERA IN THE HOPE DEPARTMENT OF THE OXFORD UNIVERSITY MUSEUM.

By F. C. Woodforde, B.A., F.E.S.

(Continued from p. 163.)

GEOMETRIDÆ.

This group has been arranged according to Mr. L. B. Prout's system worked out in Seitz's 'Macrolepidoptera of the World—Palæarctic Geometridæ.'

The group is well represented, there being very long series of most of the variable species, and no species is entirely unrepresented.

Before going further I should like, on behalf of the Hope Department, to tender thanks to those collectors who have so kindly added to the collection since these notes were first published, and especially to Mr. Greer, of Stewarts Town, who has presented a most interesting lot of Irish insects, and the Rev. C. Ash, of Saxton Vicarage, who has done the same with Yorkshire insects, so filling up several gaps in localities which were before unrepresented. Several others have also added contributions. Even the commonest species from unrepresented localities are most welcome.

Ænotherinæ.

Aplastis ononaria.—A single specimen without data from the Spilsbury Collection.

Hemitheinæ.

The sub-family is well represented.

Two remarkable male specimens of *Hipparchus* (*Geometra*) *papilionaria* bred by Prof. Poulton have a very blue tint, and stand out very conspicuously in the series. They were bred from larvæ reared by him for experimental purposes (see 'Tr. Ent. Soc.,' 1888, pp. 592–5, and 1892, pp. 310–11).

Acidaliinæ.

Acidalia immorata.—A long series with full data.

A. rubriginata.—Series of 26, 9 with data.

A. floslactata (*remutata*).—A remarkable specimen from the Meldola Collection, labelled "Forres, May 20, 1913," has a grey ground-colour with a fairly distinct grey central fascia.

A. nigropunctata (*strigillaria*).—Twenty in all, 5 with data, from the Pogson-Smith Collection, one labelled "Folkestone, 16 . 7 . 98," three others "Folkestone, 23 . 7 . 00," and the fifth, "Folkestone, 28 . 7 . 00."

Ptychopoda (*Acidalia*) *ochrata.*—Series of 19, 9 of them from the Meldola Collection, labelled "Deal."

P. serpentata (*perochraria*).—One specimen without data from the Spilsbury Collection.

Ptychopoda (*Acidalia*) *eburnata* (*Contiguaria*).—A series of 21 with data, mostly from Penmaenmawr.

P. straminata.—Series of 17 from the New Forest taken by myself; 6 from the Champion Collection from Woking; 5 *circellata* without data from the Spilsbury and Sellon Collections.

P. herbariata.—Two from the Spilsbury Collection without data.

P. holosericata.—A long series with full data.

P. osseata (*humiliata*).—Series of 13 with full data.

P. degeneraria.—Series of 26 with full data.

Cosymbia (*Ephyra*) *pendularia.*—A long series of the type. A series of 80 from N. Staffs. ranging from pale almost typical specimens up to the darkest form of var. *subroseata.* Two bred from N. Staffs. var. *subochreata*, Wdfde., one being the original type (see 'E.M.M.,' 1910, p. 114). One specimen (the type) of var. *orbiculoides*, Wdfde. (see 'E.M.M.,' 1919, p. 103). One specimen var. *decoraria*, Newman (= var. *nigrosubroseata*, Bowman), from Oxshott.

C. orbicularia.—Series of over 30, mostly bred specimens from the New Forest.

C. annulata.—Three var. *obsoleta*, Riding; 2 var. *bi-obsoleta*, Riding, from the Meldola Collection.

Larentiinæ.

Rhodometra (*Sterrha*) *sacraria.*—Two specimens from the Spilsbury Collection without data.

Lithostege griseata.—Series of 24, 13 with data.

Oporinia (*Oporabia*) *Christyi.*—Three specimens from the Meldola Collection labelled "*O. Christyi*, Ireland, bred 1910."

Eustroma (*Cidaria*) *reticulata.*—Series of 16. Fourteen with full data. Six of the specimens were presented to the collection by the Rev. E. J. Nurse, and 2 by Mr. F. Littlewood. A larva,

pupa, and a dried portion of the food-plant, *Impatiens noli-metangera*, were also presented by Mr. Nurse.

Plemyria (*Melanthia*) *bicolorata*.—A fine series of Scotch forms from the Meldola Collection includes many var. *plumbeolata* and intermediate forms.

Cidaria (*Thera*) *variata*.—A fine series of about 40, bred and taken wild by myself and the late Major Robertson in Hampshire, clearly shows the distinctness of this species from *obeliscata*. Of this latter species there is a very long series from many parts of Great Britain.

Cidaria truncata.—A very long series of English and Scotch forms. From the Hope Collection are three of Haworth's specimens of var. *comma-notata*. One of them, labelled with his characteristic MS., is probably his original type.

C. concinnata.—Seven specimens from the Meldola Collection are labelled "I. of Arran." Five more from the same collection are labelled "Tarbert, Aug. 1914." These do not show so much rufous coloration as the Arran specimens.

C. immanata.—A long and beautiful series from England and Scotland. A Haworth specimen of var. *marmorata* from the Hope Collection, and so labelled in the characteristic MS., is probably his original type.

A specimen without data from the Spilsbury Collection of var. *thingvallata*.

Xanthorrhoe fluctuata.—A long series with many interesting aberrations. A specimen from the Meldola Collection is labelled "Dunbar, Aug. 12, 1912."

It is a most remarkable specimen, and at first sight it is difficult to believe that it belongs to this species, but on the whole the markings agree, and Mr. Prout has seen and confirmed it. The base of the fore wing is pale grey, bounded outwardly by a thickish black line corresponding to the outer part of the normal dark basal blotch. This is followed by a pale grey band intersected by three white streaks corresponding with or parallel to the veins. Beyond this rather narrow band comes the unusually broad central fascia of darker grey, rather wider than normal, and extending entirely across the wing, bordered on each side by a black line, which becomes less distinct towards the inner margin. Some of the veins in the fascia are white. The discal spot is distinct in the usual place. A distinct white line borders the outer black line, and both are much less indented than in a normal form. Touching the white line at the costa is a dark blotch extending to the apex of the wing, but partially broken by the whitish subterminal line. The outer part of the wing is grey except for the subterminal line. The fringes are spotted. The hind wings are pale grey, and have only two darker lines parallel to and near to the outer edges of the wings. The fringes

are spotted. The general aspect of the specimen is much smoother and much less mottled than normal.

Xanthorrhoe (*Melanippe*) *montanata*.—A specimen of var. *costovata* without data from the Spilsbury Collection.

X. (*Coremia*) *quadrifasciaria*.—A fine series of 22 from the Oxford district, of which 18 were bred and presented by Mr. C. Rippon. There are also 6 Surrey specimens from the Champion Collection, and 2 from Essex from the Meldola Collection.

Cidaria obstipata (*fluviata*).—Series of 36. Fifteen ♂, 21 ♀. Twenty-six with full data; 10 bred, from Paignton; 16 bred, from Bournemouth.

C. sagittata.—Series of 25. Eleven with full data.

Euphyia (*Anticlea*) *cucullata*.—Series of 40. Twenty-eight with full data; of these, 6 are labelled "Perth, bred from pupa, W. H. Horwood." Sixteen were bred by myself from a wild female taken by me at Paignton, August 1st, 1919. The female parent is also in the series.

Euphyia (*Melanippe*) *unangulata*.—Series of 30, 19 with full data, mostly from Surrey and Hants.

E. picata.—Series of 25, 12 with data from Hants and Surrey.

E. (*Phibalapteryx*) *polygrammata*.—Series of 11. One labelled "Cambridge, 1878," from the collection of the late Major Robertson. Eight from the Spilsbury and 2 from the Chitty Collections, without data.

Epirrhoe (*Melanippe*) *sociata*.—A very long series. One remarkable aberration taken by myself in June, 1920, on Cannock Chase is fully described, 'Entom.,' vol. liii, p. 286.

Perizoma (*Emmelesia*) *tæniata*.—Nine specimens. Two with data. One from the collection of the late Major Robertson is labelled "Lynton, July 31, 1901." The other was taken by myself at Paignton, August 1st, 1919 ('Entom.,' 1919, p. 21).

Perizoma (*Emmelesia*) *affinitata*.—A remarkable specimen from the Sellon Collection labelled "Salway Collection" has an ochreous ground-colour instead of the normal dark brown. One specimen of ab. *turbaria*, St., from the Meldola Collection from Kent, Darenth Wood.

Hydriomena furcata (*elutata*).—A long and very varied series from many English and Scotch localities.

Eupithecia pini (*togata*).—Series of 38. Twenty-three with data, all Scotch.

E. irriguata.—The series of 26 includes 13 with full data, all from Hampshire.

E. insigniata.—A bred series of 10, labelled "Leominster, Mrs. Hutchinson." Four without data from the Spilsbury Collection.

E. palustraria (*pygmeata*).—Series of 11. Nine without data.

from the Spilsbury Collection, 2 labelled "Aberdeen, 1916," presented to the Collection by Mr. A. Horne.

E. venosata.—A long series, including 11 from Shetland with data.

E. trisignaria.—Series of 18, of which 4 from the Sellon Collection are labelled "Bred Burton, June, 1882."

E. helveticaria.—Twenty-one in series, including 12 from the Meldola Collection from Perth, with full data.

E. satyrata.—Series of 46. Thirty-six with data, including 12 var. *callunaria* and 8 var. *curzoni.*

E. tripunctaria (*albipunctata*).—Forty-three with full data and 8 without data, these last being from the Hope and Spilsbury Collections. In a series from Shropshire, bred by myself, is one specimen of var. *angelicata* entirely black, and another specimen very closely approaching, but with the white spot at the anal angle of the fore wing faintly indicated.

E. denotata (*campanulata*).—Series of 25 with full data from Worcester, Somerset and Sussex.

E. jasioneata.—Series of 19 with full data, 9 of them from Cornwall. The remaining 10 are interesting, being bred by Mr. B. G. Adams and myself from larvæ taken feeding on the flowers of Canterbury Bells in his garden in Mid-Devon far from the sea in 1915 and 1917.

E. distinctaria (*constrictata*).—A series of 21 with full data—17 from Cornwall, 2 from Gloucester, 1 from Portland, 1 from Sligo.

E. extensaria.—Series of 16 with full data.

E. fraxinata and *E. innotata.*—Series of 19, 10 with full data.

E. virgaureata.—Very poorly represented by a series of 6 from the Spilsbury Collection, without data. There were no specimens in any of the later collections.

E. debiliata.—A long series with full data from North Staffordshire, and 1 specimen from the Champion Collection from Surrey.

The genus *Eupithecia* is well represented on the whole, no species being without an example, and there are long series of most of the less rare species.

Cænocalpe (*Phibalapteryx*) *lapidata.*—Series of 21 with full data. Four from Sutherland from the Pogson Smith Collection, and 17 from Lanark from the late Major Robertson's Collection.

23E

SOME NOTES ON THE COLLECTION OF BRITISH MACRO-LEPIDOPTERA IN THE HOPE DEPARTMENT OF THE OXFORD UNIVERSITY MUSEUM.

By F. C. Woodforde, B.A., F.E.S.

(Continued from vol. liv, p. 289.)

Geometridæ, Geometrinæ.

(Arranged according to L. B. Prout's classification in Seitz's 'Palæarctic Macrolepidoptera.')

Abraxas grossulariata.—A very varied series of 135.

Most of the specimens are wild ones, with the variation tending to an increase of the black coloration, but two specimens from the Meldola Collection, taken in Wigtonshire, are almost quite white. Among the bred specimens are 3 var. *nigrosparsata*, 6 var. *lacticolor*, and 9 var. *varleyata.*

Angeroma prunaria.—A remarkable specimen of the ab. *corylaria* type from the Meldola Collection labelled "Essex. Chingford," has the usually dark base and outer margins of a pale ochreous colour with a reddish orange central band.

Gonodontis bidentata.—In the long series are 13 ab. *nigra*, Prout, from Yorkshire, and 14 from the Manchester district.

Ourapteryx sambucaria.—A specimen from the Chitty Collection, labelled "E. Woodhay, 1882," is almost pure white. A specimen of a second brood was presented by Mr. J. Collins, taken by him October 3rd, 1921.

Opisthograptis luteolata.—A specimen from the Meldola Collection, bred from a Perthshire larva, May 5th, 1912, has both hind wings and the lower half of the left fore wing pure white.

Venilia macularia.—A specimen from the Meldola Collection labelled "Kent, Dartford, June 25, 1872," is almost pure yellow, a few of the normal dark markings being very faintly shown by a pale ochreous colouring.

Macaria liturata.—The series includes 6 specimens of ab. *nigrofulvata*, Collins, 2 from North Staffs, and 4 from Delamere,

Phigalia pedaria.—The series includes many specimens of ab. *extinctaria* and ab. *monacharia.*

Nyssia zonaria.—A long series from Cheshire and Lancs, and 4 from Tiree.

Pœcilopsis lapponaria.—A long series of both ♂ and ♀.

Biston betularia.—The long series includes several forms intermediate between the type and ab. *doubledayaria.*

Boarmia repandata.—Series of over 200.

Ab. *conversaria*, ab. *nigricata* and ab. *sodorensium* are well represented. The restriction of the melanic forms to the North Midland and Northern English Counties is well illustrated.

Cleora arenaria (*viduaria*).—Series of 7 from the Spilsbury Collection, and 1 from the Sellon Collection.

Boarmia punctinalis (*consortaria*).—A long series of typical forms, and 12 melanic specimens bred from Sutton Coldfield stock, obtained from L. W. Newman.

Ectropis crepuscularia.—The long series contains many specimens of ab. *delamerensis*, from S. Wales, N. Staffs, Cheshire and Cumberland.

E. bistortata (*biundularia*).—Twenty melanic specimens from Swansea are included in the series.

E. consonaria.—The series includes 15 melanic specimens bred from larvæ of Rainham stock obtained from L. W. Newman.

Isturgia limbaria.—A long series from the Spilsbury and Chitty Collections without data, 6 from the Meldola Collection labelled "Ipswich, 1895," and 2 from the Pogson Smith Collection labelled "Ross-shire, Achanalt, 6, 91."

Ematurga atomaria.—A long and very varied series. A most remarkable male specimen from the Chitty Collection and labelled "New Forest, 1887," is pure pale yellow without any markings at all.

Itame fulvaria (*brunneata*).—A long series from Perthshire and Aberdeenshire, and two specimens from North Staffs taken in June, 1920.

Chiasmia clathrata.—A remarkable specimen from the Pogson Smith Collection taken at Nettlebed, Oxon., in August, 1892, has the ground-colour of a uniform chocolate. Towards the outer margin of all four wings are a few small white spots.

ZYGÆNIDÆ.

Zygæna purpuralis.—A long series from N. Wales, Galway and Clare.

Z. achilleæ.—A series of 8 taken near Oban in 1919 by P. C. Reid, Esq., presented by him.

Z. trifolii.—A very long and varied series showing almost every form of variation, including var. *lutescens*, Cockl., from Emsworth, presented by W. M. Christy, Esq.

Z. filipendulæ.—Nine examples of ab. *flava*, Robson, bred by L. W. Newman from Kentish stock.

SESIIDÆ.

Sciapteron tabaniformis.—Three specimens. One from the Hope Collection labelled "Ealing Gardens, 1853." One from the Spilsbury Collection without date. The third from the Sellon Collection labelled "Cummings Collection."

Sesia scoliæformis.—A series of 14 from Rannoch, and a larva taken by myself in Canncock Chase, June 7th, 1920.

S. sphegiformis.—Four specimens bred Berkshire, presented by C. Rippon, Esq. Three from the Sellon Collection labelled "Tilgate Forest," and 10 from North Staffs taken at flowers, June, 1919, by myself.

S. andreniformis.—Series of 11 with full data, all from Kent. Three from the Meldola Collection, 8 presented by B. G. Adams, Esq.

HEPIALIDÆ.

Hepialus humuli.—Included in the series are over 70 specimens of var. *hethlandica.*

(To be continued.)

[*Reprinted from the 'Entomologist's Monthly Magazine,'* 3rd ser., vol. iv.]

TRYPETIDAE FROM THE OXFORD DISTRICT, WITH NOTES ON THEIR TIME OF APPEARANCE AND FOOD-PLANTS.

BY A. H. HAMM, F.E.S.

It is long since any special reference to the time of appearance and the food-plants of the *Trypetidae* has been published in the pages of this Magazine,* and I think that a few notes on the Oxford species may be of some assistance to those who take a delight in these interesting and beautiful flies. Some of the species are to be had in abundance by sweeping or searching at the right time their respective food-plants; or again, the galls, leaves, etc., containing the larvae, may be gathered and the occupants bred in due course. Then, too, the interest taken in collecting or breeding the commoner species will inspire the naturalist to search for some at least of the rarer and little-known forms, and thus in time we may hope that the habits and food-plants of all our native species may be known and recorded. It is with this object in view that I am induced to write the following rough notes.

Nearly all the following species were taken within three to four miles from the centre of Oxford, some at least within the boundary of the City itself.

Aciura rotundiventris Fln.—This rare species was taken as long ago as June 23rd, 1832, by the Rev. A. Matthews, at Weston-on-the-Green, near Oxford. † I have not met with it so far.

Acidia cognata W.—A few taken in various years, always at the end of June, resting on the upper-side of alder-leaves, Hogley Bog, near Cowley, Oxon, and several in a garden on Shotover Hill, on lilac-leaves, July 1, 1917.

A. heraclei L.—This is the well-known parsnip and celery fly, but away from gardens it is not at all plentiful. It can, however, usually be swept from *Heracleum*. My friend Mr. H. Britten bred it in large numbers during July 1916, from the blotched leaves of parsnips growing in his garden at Headington. Similar blotched leaves were present in almost every patch of parsnips looked at in gardens and allotments all over the district, but I believe it does little or no harm to this useful vegetable.

Gonyglossum wiedemanni Mg.—I have only met with this species on two occasions, both on Shotover Hill, probably swept from *Heracleum*.‡

* R. C. Bradley, Ent. Mo. Mag. 1901, p. 9.

† C. W. Dale, Ent. Mo. Mag. 1904, p. 212.

‡ *G. wiedemanni* is to be found occasionally in numbers on *Bryonia dioica*.—J. E. C.

The first was taken June 19th, 1915, the second on June 30th, 1917. Care should be taken that this species is not passed over for *A. heraclei*, which it closely resembles, especially in the net.

Spilographa zoë Mg.—Occurs sparingly, always on thistles, chiefly *Cnicus lanceolatus*, at various localities in the district, the University parks, Shotover Hill, and Headington Wick Copse. End of May and June.

S. artemisiae F.—Until last season (1917) this fly had only occurred very sparingly, probably because I had not hit upon the right time or place. On July 28th, in and around Hogley Bog, it was taken plentifully by sweeping mugwort (*Artemisia vulgaris*). My other dates extend from May to August.

Trypeta onotrophes Lw.—One individual was swept from the marsh thistle (*Cnicus palustris*), near Bayswater Mill, on July 14th, 1917.

T. cornuta F.—This species was extraordinarily abundant during the past season, and could have been obtained in hundreds during July by sweeping the large knapweed (*Centaurea Scabiosa*). It was especially common on and around Shotover Hill, but also occurred all over the district. The smaller black knapweed (*C. nigra*) was also swept whenever met with but did not yield the fly. This is a most beautiful insect when alive, of a lovely pale green colour, which soon fades after death.

T. tussilaginis F.—One specimen by sweeping in a rough clay-pit, Shotover Hill, August 11th, 1917. There was plenty of coltsfoot growing all over the pit, but I could not decide whether the specimen came off that plant, for persistent sweeping failed to yield another.

T. florescentiae L.—This elegant little fly is evidently attached to the marsh thistle (*Cnicus palustris*). A rough pasture-field on the north side of Shotover Hill is much overgrown with this tall thistle, the flower-heads of which, when swept on July 7th, 1917, yielded a fine series. Other species of thistle growing in the same field were also tried, but entirely without success. A week later, near Bayswater Mill, Headington, the marsh thistle was again tried and a few more examples taken.

T. colon Mg.—This species, so far, has proved rather scarce here. About a dozen specimens have been taken by sweeping the knapweed (*Centaurea Scabiosa*), during July, on Shotover Hill and Hogley Bog. Somewhat variable in colour.

T. serratulae L.—This, again, is not a plentiful species in the district. It has only been obtained by sweeping the musk thistle (*Carduus*

nutans) growing in fair abundance on Open Brasenose Common. A small series was the reward of sweeping for an hour or two on July 21st last.

T. acuticornis Lw.—I have only met with this species on one occasion, August 16th, 1916, when a nice series was boxed from the heads of the woolly-headed thistle (*Cnicus eriophorus*). A fine patch of this beautiful plant was growing in abundance in an old disused quarry, near Wood Farm, Cowley. I found that searching the heads of the thistle proved more effectual than sweeping. The flies were all boxed from the exterior of the woolly receptacle, the insects' pale colour aiding them considerably in their resemblance to the environment.

Urophora solstitialis L.—A good series of this beautiful fly was secured during July and August 1917 by regularly sweeping the musk thistle (*Carduus nutans*), on Brasenose Common and Hogley Bog. The best time was about the middle of July. This species, too, can be boxed from the thistles if searching be preferred to the more laborious method of sweeping.

U. stylata F.—The most abundant species of the genus, being found everywhere in the district, either by sweeping or searching the spear thistle (*Cnicus lanceolatus*), during June and July. It was especially abundant on Shotover Hill on July 7th, 1917. The hard, nut-like galls formed by the larvae of the fly in the abortive seed-head of the thistle are easily found during autumn, and these, if kept in a fairly cool place, not too dry, will readily emerge the following year, sometimes four or five flies appearing from a single gall. The wing-markings of this species vary considerably, even in individuals bred from the same gall.

U. aprica Fln.—Has been taken by my friend and colleague, Mr. J. Collins, near Islip.

U. quadrifasciata Mg.—Also obtained by Mr. Collins at Water Eaton. This and the preceding species have not, so far, been taken by the writer, and I do not know the plant or plants from which they were swept.

U. cardui L.—This curiously marked fly is not met with so often as one would expect, judging from the numbers of its well-known gall on the stems of the (all too common) creeping thistle (*Cnicus arvensis*). It seems somewhat local, but has been found throughout the district. The insect should be looked for in June. Those desirous of breeding it successfully should allow the galls to mature before being gathered (as the larvae pupate within the gall). Gathering should be deferred until late

autumn, and if the galls are kept as recommended for *U. stylata* the flies can be bred the following year.

Sphenella marginata Fln.—Not an abundant species. I have taken a few by sweeping various thistles and ragwort, chiefly in the neighbourhood of Shotover Hill, during July and August.

Carphotricha guttularis Mg.—Not uncommon in a piece of rough pasture, on Shotover Hill, during July 1916. Both Mr. Britten and myself endeavoured to determine the plant from which they were swept, but neither of us could come to any certain conclusion. Perhaps the flies came from ragwort more frequently than any other plant.

Ensina sonchi L.—This very small, pale Trypetid was exceedingly abundant all over the district last autumn (September and October), and obtained by sweeping various *Compositae*, such as dandelions, hawkweeds, fleabane, etc. It was not, however, swept from *Sonchus* after many attempts, in spite of its name. This small fly bears a striking resemblance in colour to the grass-seeds of many kinds that are so plentiful at this time, and mixed up together as they all are in the sweeping-net, the insects are hard to distinguish; but in a short time, the flies begin to crawl up the sides of the net and can then be readily boxed or tubed.

Tephritis miliaria Schrk.—Not uncommonly taken by sweeping the creeping thistle (*Cnicus arvensis*). It occurred locally throughout the district from June to August.

T. (*Oxyna*) *proboscidea* Lw.—Taken by Mr. J. Collins, first at Wolvercote, June 15th, 1911, and again at Sunnymeade, July 8th, 1915, on both occasions by sweeping low herbage.

T. (*Oxyna*) *absinthii* F.—I have only taken this species once—near Brasenose Common, August 10th, 1915,—by sweeping a low bank with short herbage.

T. hyoscyami L.—Occurs both in spring and autumn. I have taken it plentifully by sweeping the spear thistle (*Cnicus lanceolatus*) in early June, and again in August, from the same patch of thistles. It also hibernates. Mr. Britten, after beating furze on Shotover Hill, March 4th, 1916, for *Coleoptera*, etc., gave me a sample of the various flies he had obtained, and among them was a specimen of this species. On April 1st we visited the same spot together, and by vigorous beating obtained a few more examples. Those who have never tried beating furze for Diptera during the winter months may be advised that many interesting species of hibernating flies can be obtained in this way.

T. vespertina Lw.—In my experience, undoubtedly the commonest species of Trypetid, to be found practically throughout the year, inasmuch as it hibernates like the preceding species. It was beaten from the furze-bushes in large numbers, at the same time and place as recorded for *T. hyoscyami*. *T. vespertina* may also occasionally be found on fences, etc., during warm days in mid-winter. In the summer it can be swept in abundance from *Compositae*.

T. bardanae Schrk.—Not a very common species in this district, but swept several times from the common burdock (*Arctium Lappa*), in June, at Hogley Bog and Headington Wick Copse.

Palloptera umbellatarum F.—Another fly, which has habits similar to those of a Trypetid, was constantly found in the sweeping-net in company with *U. stylata*. The females were often observed probing the flower-heads of the spear thistle with the extruded ovipositor. Whether the species breeds in the thistle-head or is parasitic on *U. stylata* I have not been able to ascertain.

My best thanks are due to Mr. J. E. Collin and Mr. C. G. Lamb for kindly naming or confirming the determination of doubtful species; also to my friend Mr. H. Britten, for his able assistance during our joint collecting excursions.

22 Southfield Road, Oxford.
March 1918.

FOURTH SUPPLEMENT

TO THE

PRELIMINARY LIST

OF

COLEOPTERA

IN THE

REPORT FOR 1906,

BY

JAMES J. WALKER,
HON. M.A., R.N., F.L.S.,
Secretary of the Entomological Society of London.

pp. 62-68.

FOURTH SUPPLEMENT

TO THE

PRELIMINARY LIST OF THE COLEOPTERA OF THE OXFORD DISTRICT,

Published in the Report of the Ashmolean Natural History Society of Oxfordshire for 1906.

BY JAMES J. WALKER, Hon. M.A., R.N., F.L.S.

The three years that have elapsed since the publication of the Third Supplement to our 'Preliminary List of *Coleoptera*' have, as before, been marked by steady work at our local beetle-fauna by my energetic colleagues and myself; and each year has witnessed the addition of a fair number of rare and interesting species. We have to regret the loss of Mr. W. Holland, who left Oxford about two years ago, but his place in our little band of workers has been efficiently filled by his successor in the 'Hope Department,' Mr. H. Britten, F.E.S., to whose intimate acquaintance with the smaller forms of British beetles we are indebted for the records of many species in the more obscure families. Through his kindness I am for the first time able to include more than twenty species of the family *Trichopterygidæ,* the members of which are the smallest, and are certainly among the most difficult to determine, of our indigenous *Coleoptera.* The share of Mr. J. Collins in the discovery of species new to our local list is, as usual, a large one, and some valuable additions have been made by Mr. H. G. Champion and Mr. A. H. Hamm. As our district is more closely and systematically worked, new records are naturally fewer year by year, but the number of species (97) in the present Supplement brings the *Coleoptera* recorded since the time of the Rev. F. W. Hope within the 'seven-mile radius' up to the very satisfactory total of about 1,950 species.

On the whole, the past year may scarcely be regarded as having been a good one for *Coleoptera.* A fair number of

interesting captures were made during the spring and early summer, but the autumnal collecting was completely ruined by the abnormal drought of September and October, which was followed by continuous and almost unprecedented wet weather to the end of the year, during which time outdoor work of any kind was almost impossible.

Family **Carabidæ.**

Leistus rufescens, Fab. By sweeping on the 'Ruskin Plot' at Cothill, singly, 20th June and 13th September, 1913.

***Tachys bistriatus, Dufts.** On the bank of a pond in Wytham Park; one specimen, June, 1913 (*H. G. Champion*).

***Bembidium riparium, Ol.** Occurs sparingly on river banks with *B. biguttatum*, Sahlb. (*J.C.*).

Family **Dytiscidæ.**

***Agabus uliginosus, L.** This very local species has been taken singly in flood-refuse at Sparsey Bridge, Water Eaton, by Mr. J. Collins, in January, 1913, and by myself on 2nd May, 1913.

Family **Hydrophilidæ.**

***Henicocerus exsculptus, Germ.** One example taken in water-net, Gosford Bridges, 25th June, 1913.

***Ochthebius margipallens, Latr.** In flood-refuse, Sparsey Bridge, rare, 24th January, 1912.

Family **Staphylinidæ.**

****Aleochara moesta, Grav.** Occurs sparingly throughout the district in company with *A. succicola*, Thoms. (*H.B.*).

****Ilyobates forticornis, Lac.** In flood-rubbish, Sparsey Bridge, very rare; taken singly by Mr. Collins in January, 1912, and by myself, 8th January, 1913, and 31st December, 1914.

***Homalota luteipes, Er.** Shotover Hill; one specimen in a nest of the ant *Lasius fuliginosus*, Latr., 22nd March, 1914 (*A.H.H.*).

H. malleus, Joy. Yarnton, 2nd November, 1908 (*J.C.*).

H. obtusangula, Joy. Marston, 1st July, and Wood Eaton, 10th July, 1908 (*J.C.*).

H. tomlini, Joy. Wytham, 20th April, 1905, and Yarnton, 4th August, 1908 (*J.C.*).

These species have been recently separated from *H. melanocera*, Thoms. (*volans*, Scriba) by Dr. N. H. Joy. *Cf.* Entom. Mo. Mag., 1913, pp. 57, 58.

****H. occulta, Er.** Cothill, singly, May 7th, 1910 (*J.C.*); Lye Hill, near Cowley, in carrion, 7th March, 1914 (*H.B.*).

***H. decipiens, Sharp.** Apparently widely distributed in damp places with *H. analis*, Grav.; Wood Eaton and Wytham Park (*J.C.*), Brasenose, Headington, Bullingdon Bog (*H.B.*). I have found it recently in flood-refuse from Sparsey Bridge.

****H. soror, Kr.** In flood-refuse, Duke's Cut, near Yarnton, 27th March, 1914 (*J.C.*).

H. reperta, Sharp. In fungus, Water Eaton, 24th June, 1910, and at Tubney, 9th October, 1911 (*J.C.*).

H. inoptata, Sharp. Generally common in fungi. This and the preceding species have been separated by Dr. Sharp from *H. fungicola*, Thoms.

H. sodalis, Er. Taken at Cothill, sparingly, 18th July, 1909 (*J.C.*).

****H. autumnalis, Er.** In rotten oak boughs at Hen Wood; a series taken 17th August, 1908 (*J.C.*).

****H. liliputana, Bris.** One example of this rare little species taken at Wytham Park in 1907 (*J.C.*).

***H. germana, Sharp.** Taken at Besselsleigh, 6th September, 1908; also at Wood Eaton, Enslow Bridge and Wytham (*J.C.*).

***H. sordidula, Er.** Wood Eaton, 11th April, 1908; Duke's Cut, Yarnton, 11th September, 1914 (*J.C.*).

***H. canescens, Sharp.** Taken singly at Cothill, 10th April, 1909, and near Wytham, 6th August, 1910 (*J.C.*).

****H. lævana, Rey.** One example at Tubney, 30th March, 1907 (*J.C.*).

H. muscorum, Bris. Wytham, one example, 14th May, 1910; King's Weir, in haystack, 9th April, 1910 (*J.C.*).

[**H. fungi, Grav.**, var. **dubia, Sharp.** This well-marked form, which merits specific rank, is widely distributed throughout the district.]

****H. orphana, Er.** Taken singly at Cothill, 29th August, 1910, and at Tubney, 19th August, 1912 (*J.C.*).

****Gyrophæna pulchella, Heer.** Cothill; sparingly in toadstools, 19th August, 1914.

[**G. convexicollis, Joy.**] Recorded in error from Yarnton as *G. lucidula*, Er. (First Supplement, Prel. List Coleop., Oxford, p. 58). It has been taken rather freely by evening sweeping at Prattle Wood by myself, also at Wytham Park by Mr. Collins.]

***Hypocyptus discoideus, Er.** In flood-refuse, Sparsey Bridge, rare, January, 1912 (*J.C.*).

****Mycetoporus angularis, Rey.** By sweeping under fir trees at Tubney; one specimen, 10th May, 1913.

****Xantholinus cribripennis, Fauv.** One ♂ example of this rare northern species taken by Mr. J. Collins at Cothill, 3rd April, 1910; a ♀ found in a mole's nest at Bullingdon Bog by Mr. H. Britten, 17th October, 1914.

***Stilicus fragilis, Grav.** One example under a birch faggot at Cothill, 28th September, 1913 (*J.C.*).

***Stenus lustrator, Grav.** In flood-refuse, Sparsey Bridge, rare, January, 1912 (*J.C.*). This species is not uncommon in the peat-bog at Weston-on-the-Green.

***S. ærosus, Er.** By evening sweeping at Wood Eaton; not rare, 8th May, 1912.

***Bledius longulus, Er.** Found in plenty by Mr. H. Britten and Mr. A. H. Hamm, burrowing in sandy banks at Shotover brick-pit, in company with *B. opacus*, Block; October, 1914. Taken rarely at Tubney, June and July, 1910 (*J.C.*).

***B. femoralis, Gyll.** One example at Shotover, 2nd May, 1914 (*H.B.*).

***Platystethus nodifrons, Sahlb.** Taken rarely in flood-refuse at Duke's Cut, December, 1914 (*J.C.*).

****Oxytelus fulvipes, Er.** In a tuft on the railway bank near Yarnton, one specimen, January 17th, and a second in flood-refuse at Duke's Cut, 25th March, 1914.

***O. clypeonitens, Pand.** Taken not uncommonly flying in the University Museum grounds, 26th March, 1914 (*H.B.*).

***O. fairmairei, Pand.** Single specimens taken near Wytham, 13th March and 25th May, 1910 (*J.C.*).

Family **Clambidæ.**

****Clambus punctulum, Beck.** Occurs sparingly with *C. armadillo*, De G., in flood-refuse, &c. (*H.B.*).

Family **Silphidæ.**

****Choleva longula, Kelln.** By sweeping at Wytham Park; one specimen, 25th October, 1913.

****Colon denticulatum, Kraatz.** By sweeping at Tubney; one ♂ specimen, 31st August, 1912.

Family **Clavigeridæ.**

****Claviger longicornis, Müll.** This very interesting addition to the British Coleopterous fauna was first taken at Gibraltar Quarries, Oxon, during the excursion of the Ashmolean Natural History Society on 31st May, 1906. Five examples were then found in nests of the black ant *Lasius niger*, L., under small stones. A few more were taken in the same spot in the spring of 1907, and in 1913 the insect again occurred there very rarely to Mr. Collins and myself. Mr. Britten also took a single specimen at Shotover, 18th April, 1914. (*Cf.* Entom. Mo. Mag., 1912, p. 100.)

Family **Pselaphidæ.**

***Euplectus signatus, Reich.** This species, previously recorded in error from the District, was found not rarely in a haystack near Cumnor, 5th May, 1912 (*J.C.*).

Family **Trichopterygidæ.**

Pteryx suturalis, Heer. In dead boughs; Tubney, 10th April, 1909, also at Cothill (*J.C.*).

***Ptinella denticollis, Fairm.** Under bark of an oak log, Water Eaton Grove, not rare, 15th October, 1911; also taken at Cothill by Mr. Collins, 27th April, 1914.

***Trichopteryx thoracica, Waltl.** Water Eaton, rare, 30th April, 1910 (*J.C.*).

T. atomaria, De G. In wet moss at Yarnton, August, 1908, also at Wytham (*J.C.*).

T. grandicollis, Mann. In vegetable refuse, &c.; generally common.

T. lata, Mots. With the preceding species; not rare.

T. fascicularis, Hbst. In haystack refuse; Yarnton and Tubney, not rare (*J.C.*).

***T. sericans, Heer.** Taken flying in High Street, Oxford, 1914 (*A.H.H.*).

***T. brevipennis, Er.** In rotten wood at Water Eaton, singly, 6th March, 1910 (*J.C.*).

***T. montandoni, All.** In hollow elm at Water Eaton, 1st August, 1908 (*J.C.*); found by me in plenty in elm stump near Tubney, April, 1910.

Ptilium kunzei, Heer. In vegetable refuse at Headington, July, 1914 (*H.B.*).

****P. rugulosum, All.** In rotten wood, Wytham Park, 6th August, 1910, and at Tubney, 12th April, 1914, rare (*J.C.*).

***P. exaratum, All.** Cumnor, May 5th, 1912 (*J.C.*); Headington and Brasenose (*H.B.*).

P. foveolatum, All. In haystack refuse at Lye Hill, 7th March, 1914 (*H.B.*).

***Nossidium pilosellum, Marsh.** In rotten wood, occasionally by sweeping; has occurred at Wytham Park on several occasions to Mr. Collins and myself.

***Ptenidium fuscicorne, Er.** Wood Eaton, rare, in wet place, 17th April, 1908 (*J.C.*).

P. nitidum, Heer. In manure-heaps, vegetable refuse, &c.; generally common.

P. lævigatum, Gyll. Taken by Mr. Collins at Yarnton, February, 1909.

****P. gressneri, Er.** In hollow stump of elm near Tubney, in company with *Trichopteryx montandoni*, All., and *Ptenidium nitidum*, Heer; not rare, 15th April, 1910.

FAMILY **Corylophidæ.**

***Orthoperus mundus, Matt.** In hard fungus on birch, several at Wytham Park, 15th August, 1908 (*J.C.*).

***O. coriaceus, Rey.** Beaten out of spruce-firs, Tubney, 5th June, 1910; also in moss on oak trunks at Prattle Wood and by sweeping at Wytham (*J.C.*).

FAMILY **Coccinellidæ.**

***Hyperaspis reppensis, Hbst.** Tubney; one specimen in sand-pit, May 28th, 1914.

***Scymnus redtenbacheri, Muls.** This species has occurred rarely to me by sweeping at Cothill and Tubney.

FAMILY **Histeridæ.**

***Hister neglectus, Germ.** One specimen in flood-refuse, Sparsey Bridge, January, 1912 (*J.C.*).

FAMILY **Nitidulidæ.**

****Epuræa diffusa, Bris.** By sweeping near Cothill; one specimen, 6th August, 1913 (*J.C.*).

***E. parvula, Sturm.** In birch faggots at Cothill, rather commonly, 20th September, 1913.

****E. angustula, Er.** One example of this rare and usually northern species taken by sweeping under beech trees at Wytham Park, 30th July, 1913.

***Nemosoma elongatum, L.** This very interesting beetle has been taken rather freely in all its stages under bark of elm rails at Water Eaton, in company with *Hylesinus vittatus*, F., on which it is parasitic. First found by Mr. J. Collins, 3rd August, 1913.

***Cryptophagus badius, Sturm.** In a cellar at Headington, rare, 21st February, 1914 (*H.B.*).

****C. validus, Kraatz.** By sweeping near Enslow Bridge, 3rd August, 1913 (*J.C.*).

***C. pallidus, Sturm.** In haystack refuse, Water Eaton, rare, 20th February, 1910 (*J.C.*).

****Micrambe abietis, Payk.** By sweeping at Wytham Park; one specimen, 16th October, 1913.

***Atomaria fumata, Er.** In tufts of grass at Wolvercote Paper Mill; rare, 31st March, 1913.

Heterocerus marginatus, F. This species, formerly recorded in error, has been found not uncommonly in wet muddy places at Shotover, Godstow, &c. (*J.C.*).]

FAMILY **Scarabæidæ.**

***Copris lunaris, L.** One dead but perfect ♀ specimen of this conspicuous beetle picked up by the roadside at Tubney, 17th May, 1913.

FAMILY **Telephoridæ.**

***Rhagonycha unicolor, Curt.** A pair taken by sweeping at Wytham Park, 8th June, 1911 (*J.C.*).

FAMILY **Cerambycidæ.**

****Criocephalus ferus, Muls.** One ♀ specimen taken by Mr. T. Trollope in his house at Summertown, 21st August, 1914 (*J.C.*). (*Cf.* Ent. Mo. Mag., 1914, p. 246.)

***Molorchus minor, L.** Taken singly by sweeping flowers at Cothill, 18th May, and at Bladon Heath, 7th June, 1913 (*J.C.*).

FAMILY **Chrysomelidæ.**

***Donacia clavipes, F.** On rushes at King's Weir, singly, 14th June, 1914 (*J.C.*).

***Phyllobrotica quadrimaculata, L.** One example on alder, Bullingdon Bog, 23rd June, 1912 (*A.H.H.*).

***Longitarsus anchusæ, Payk.** On *Echium vulgare,* Hitch Copse, near Cothill; rare, 28th June, 1913.

***L. curtus, All.** Wytham Park; taken sparingly by sweeping [*Echium*], &c., autumn, 1912 (*J.C.*); and by myself in October, 1913.

***L. ballotæ, Marsh.** On *Ballota nigra* at entrance of Kennington Lane; locally common, 19th September, 1914.

***Phyllotreta diademata, Foudr.** This species (first identified by Mr. H. Britten) appears to be widely but sparingly distributed throughout the district on various Cruciferous plants.

****Psylliodes luteola, Müll.** First taken by Mr. J. Collins sparingly near Enslow Bridge by sweeping grass, &c., August, 1912. It has since been found more freely by the roadside under the north wall of Kirtlington Park, as well as in the Park itself, in September and October by myself.

****Cassida hemisphærica, Hbst.** One specimen in Tubney sand-pit, May 24th, 1913 (*H. G. Champion*); a pair taken by myself by sweeping, Tubney, 27th September, 1913.

FAMILY **Rhipidophoridæ.**

***Metœcus paradoxus, L.** This curious and interesting beetle was found in a nest of *Vespa vulgaris,* L., at Tubney by Mr. Hassan, of Lincoln College, August, 1913 (*A.H.H.*); also near Summertown by Mr. W. Hainge, 4th September, 1913 (*J.C.*).

FAMILY **Xylophilidæ.**

***Xylophilus oculatus, Gyll.** One specimen by sweeping under beech trees at Wytham Park, 30th July, 1913.

FAMILY **Curculionidæ.**

Apion immune, Kirby. On broom at Boar's Hill, rare, 19th April, 1912.

****Gymnetron collinus, Gyll.** Found sparingly on *Linaria vulgaris* near Tubney, in company with *G. linariæ,* Panz., in plenty; first taken 15th September, 1912 (*J.C.*).

***Balaninus rubidus, Gyll.** On small birch trees; Tubney, 14th September, 1913, and Cothill, 13th August, 1914, rare (*J.C.*).

FAMILY **Scolytidæ.**

Scolytus rugulosus, Ratz. This species, previously recorded in error, was taken by Mr. Collins by sweeping at Tubney, 16th August, 1913.

***Xyleborus saxeseni, Ratz.** Found sparingly with *Trypodendron domesticum,* L., in dead beech boughs in lane from Wytham to the Park, June, 1913 (*J.C.*).

31st December, 1914.

FIFTH SUPPLEMENT

TO THE

PRELIMINARY LIST

OF

COLEOPTERA

IN THE

REPORT FOR 1906,

BY

JAMES J. WALKER,

HON. M.A., R.N., F.L.S.,

Secretary of the Entomological Society of London.

FIFTH SUPPLEMENT

TO THE

PRELIMINARY LIST OF THE COLEOPTERA OF THE OXFORD DISTRICT,

Published in the Report of the Ashmolean Natural History Society of Oxfordshire for 1906.

By JAMES J. WALKER, Hon. M.A., R.N., F.L.S.

The investigation of the Coleopterous fauna of our District has been continued without interruption, despite the many troubles of the last six eventful years, and the additions herewith presented to our extensive local list of beetles include a considerable number of rare and interesting species, the names of which appear in our Reports from 1915 onwards. Advantage has been taken of the present opportunity to include several notable species which have been found in past years at Weston-on-the-Green and other localities just beyond the conventional 'seven-mile radius' from Carfax; and some of these without doubt will be found within its limits in course of time. Other additions have resulted from the revision by well-known Coleopterists in recent years of certain of the more obscure and difficult genera of beetles; and the very important paper on the British *Stylopidae* by Dr. R. C. L. Perkins, F.R.S., in the 'Entomologist's Monthly Magazine' of April, 1918 (Vol. LIV, pp. 67-78), has enabled our colleague, Mr. A. H. Hamm, who has made a special study of these wonderful parasites of the *Hymenoptera,* to add very largely to the number of species which occur in the District. Another very important contribution to biological science in connection with these insects has been made by the late Mr. Geoffrey Smith, of New College, and Mr. Hamm, chiefly based on material obtained at

Oxford.* On the other hand, several species, mostly included in the 'Preliminary List' of 1906 in error, or on what now appears to be insufficient evidence, must be withdrawn. These are as follows:—

Harpalus (*Ophonus*) *puncticollis*, Payk., *H. parallelus*, Dej., *Anchomenus sexpunctatus*, L., *A. versutus*, Gyll. (there is no suitable locality in the district for these eminently heath- and *Sphagnum*-frequenting species), *Myllaena kraatzi*, Sharp, *Thinobius linearis*, Kr., *Coccidula scutellata*, Herbst., *Lamprosoma concolor*, Sturm, *Gymnetron villosulus*, Gyll., *Halictophagus curtisii*, Dale.

The revision of the difficult species of the genus *Haltica* by Dr. D. Sharp (Ent. Mo. Mag., 1914, pp. 259-264), involves the following corrections to the 'Preliminary List':—

Haltica ericeti, All. Occurs very rarely on heather at Tubney.

H. ytenensis, Sharp (*oleracea*, Brit. Coll., *nec* L.). This is the commonest species of the genus throughout the District, and is found almost everywhere on a great variety of plants (*Epilobium, Helianthemum, Calluna*, &c.).

H. pusilla, Dufts. On limestone soils, by sweeping *Helianthemum*, &c.; Bayswater Mill, Wytham Park, sparingly; also at Wychwood Forest.

By the removal of Mr. H. Britten from Oxford we have lost one of our most successful workers, especially in the minute and more difficult groups of beetles, but, as before, a large number of the most important and interesting additions to the local list of *Coleoptera* are due to the undimished energy of Mr. J. Collins.

The 130 species included in the present 'Supplement' bring the total number of *Coleoptera* recorded from the Oxford District (allowance being made for withdrawals) to the very satisfactory figure of 2,070 species. Ample material now exists for a comprehensive annotated list of the Oxford beetles, on the model of the 'Entomologia Edinensis,' a useful little volume well known to working Coleopterists; but the prohibitive cost of such a work at the present time necessitates the indefinite postponement of this undertaking.

* Smith, Geoffrey, M.A., and Hamm, A. H., 'Studies in the Experimental Analysis of Sex. Part II—On Stylops and Stylopisation,' *Quart. Journ. Micr. Science*, Vol. 60, pp. 435-461, plates 32-35.

FAMILY **Carabidæ.**

Ophonus (Harpalus) brevicollis, Dej.
O. rectangulus, Thoms.
These two species, recorded under the name of *H. puncticollis,* Payk., are locally common throughout the district. *Cf.* D. Sharp, Entom. Mo. Mag., 1912, pp. 183, 229.

***Tachypus pallipes, Dufts.** Cumnor, in sand-pit, one example, July, 1916 (*J.C.*).

***Lebia chlorocephala, Hoffm., var. chrysocephala, Mots.** This well-marked variety has occurred on two or three occasions in tufts of grass in Bagley Wood; first taken March 13th, 1915.

***Dromius quadrisignatus, Dej.** Tubney Wood, under oak bark, one example, June 12th, 1915. (Recorded from "Weston, Oxfordshire, under bark of firs," probably by the Rev. A. Matthews.)

FAMILY **Haliplidæ.**

***Haliplus fulvus, F.** Yarnton, one example (*J.C.*)

H. heydeni, Wehncke
H. wehnckei, Gerk.
These two species have been recently separated from *H. ruficollis,* De G. and have been identified by Mr. H. Britten. Apparently not rare.

FAMILY **Dytiscidæ.**

***Hydroporus melanarius, Sturm.** Boar's Hill, one example, May, 1918 (*J.C.*).

***H. ferrugineus, Steph.** In small dried-up pond near Stanton St. John; one, July 3rd, 1918.

*[**Agabus biguttatus, Ol.** A good many examples taken by Mr. J. Collins in the mill-stream at Weston-on-the-Green, April, 1907.]

FAMILY **Gyrinidæ.**

***Gyrinus urinator, Ill.** In the mill-stream, Gosford Bridges, a pair, September 6th, 1918.

FAMILY **Hydrophilidæ.**

Enochrus bicolor, Payk. Has occurred rarely in flood-refuse at Sparsey Bridge, &c., to Mr. Collins and myself.

****Helophorus granularis, L.**
H. walkeri, Sharp.
These two species have been taken in stagnant water at Shotover Hill by Mr. H. Britten.

Sphæridium quadrimaculatum, Marsh. Recently recognised as distinct from *S. scarabæoides,* L.; first taken in 1906 (*J.C.*).

Cercyon marinus, Thoms. In small pond on Shotover Hill, rare, August, 1917 (*H.B.*).

***Cerycon sternalis, Sharp.** Yarnton, in wet moss, 1908 (*J.C.*); not rare in flood refuse, Duke's Cut, &c.

***C. minutus, F.** Occurs sparingly with the preceding species.

FAMILY **Staphylinidæ.**

***Ocyusa picina, Aubé.** Wytham Park, in wet moss, rare, April 24th, 1920. It is common in moss, grass-tufts, &c., at Weston-on-the-Green.

***Oxypoda pectita, Sharp.** Marston Ferry Lane, in manure-heap, one, March 24th, 1917.

***Ocalea castanea Er.** Wytham Park, in dead leaves, rare, February 18th, 1920.

***Homalota hygrotopora Kr.** In moss, Bayswater Brook, rare, June 17th, 1917 (*H.B.*).

****H. crassicornis, Gyll.** Wood Eaton, December 7th, 1919 (*J.C.*); also at Wolvercote Paper Mill.

***H. exillima, Sharp.** Mesopotamia, spring, 1915 (*H.B.*). Often plentiful in flood-refuse.

****H. exarata, Sharp.** This rare species has been obtained by sweeping on two or three occasions at Boar's Hill, and once on Shotover Hill. First taken May 22nd, 1917.

***Tachyusa constricta, Er.**
***T. flavitarsis, Sahlb.**
These two species were taken by the late Mr. A. J. Chitty in a wet place on Shotover Hill, May, 1907.

Gyrophæna gentilis, Er. Tubney, October 16th, 1915, rare (*J.C.*).

***G. bihamata, Thoms.** Wytham Park, 1919 (*J.C.*); Magdalen College grounds, in fungi (*H.B.*).

***G. lucidula, Er.** Wytham Park, in wet moss, one specimen, March 20th, 1920.

***Placusa infima, Er.** Wytham Park, under sappy bark of beech, sparingly, October, 1919.

****Oligota parva, Kr.** Headington, in refuse, Spring, 1915 (*H.B.*).

Myllæna dubia, Grav. Yarnton, in moss, August 2nd, 1908; Tubney, 1917 (*J.C.*).

M. intermedia, Er.
***M. elongata, Matth.**
M. gracilis, Matth.
These species have been taken in Shotover Brick-pit by Mr. H. Britten, Spring, 1915.

Tachyporus tersus, Er. Shotover Hill, not uncommon in moss, &c. (*H.B.*).

***Tachinus collaris, Grav.** Sparsey Bridge, in flood-refuse, rare, March, 1916.

***Mycetoporus nanus, Er.** In moss on bank of a pond, Tubney, one example, March 25th, 1916.

****Ocypus cyaneus, Payk.** This fine and rare beetle was first taken in a small sand-hole between Besselsleigh and Tubney, July 23rd, 1916 (Ent. Mo. Mag., 1916, p. 205); and it has occurred very sparingly in the same district in the three following years (*J.C.*).

***Actobius villosulus, Steph.** Marston Ferry, in flood-refuse, one specimen, May 17th, 1918.

***Stenus fuscicornis, Er.** Wytham Park, by sweeping, one specimen, September, 1918.

***Trogophlœus tenellus, Er.** Duke's Cut, in flood-refuse, rare, December, 1915.

****T. subtilis, Er.** The insect recorded in Supplement III (1911), under the name of *Thinobius linearis*, Kraatz, is to be referred to this very rare species.

****Homalium gracilicorne, Fairm.** Wytham Park, by sweeping, one specimen, Autumn, 1915.

****Proteinus crenulatus, Pand.** Shotover, in fungus, very rare, August, 1915 (*H.B.*).

Megarthrus affinis, Müll. Marston Ferry Lane, by sweeping, May, 1915.

***Phlœocharis subtilissima, Mann.** Shotover, in fungus, very rare, August, 1915 (*H.B.*).

Family Silphidæ.

****Anisotoma lunicollis Rye.** A male example of this rare species taken by sweeping at Tubney, August 27th, 1917 (*J.C.*).

***Choleva glauca, Britt.**
***C. sturmi, Bris.** These two species, separated by Mr. H. Britten from *C. angustata*, F. (Ent. Mo. Mag., 1918, pp. 30-33), occur sparingly in moles' nests, vegetable refuse, &c.

***C. morio, F.** In flood-refuse, moles' nests, &c.; widely distributed and not rare (*J.C.*).

Family Scydmaenidæ.

****Euconnus mäklini, Mann.** A male example of this exceedingly rare insect taken by evening sweeping near Bayswater Mill, July 19th, 1916.

****Euthia formicetorum, Kr.** In decayed oak boughs, Prattle Wood; two examples, April 14th, 1915.

Family Pselaphidæ.

****Bythinus distinctus, Reich.** By evening sweeping near Marston Ferry, one, August 6th, 1917.

****Euplectus aubeanus, Reitt.** By sweeping under hedges near Marston Ferry, rare, early summer; first taken May 8th, 1918.

Family Trichopterygidæ.

[****Ptinella britannica, Matth.** Weston-on-the-Green, on back of slug (*Rev. A. Matthews*).]

***P. aptera, Guér.** Under bark near Bayswater Mill, scarce, May 13th, 1916 (*H.B.*).

****Trichopteryx fratercula Matth.** In flood-refuse, Sparsey Bridge, rare, 1916 and 1918 (*J.C.*).

[****T. poweri, Matth.** Weston-on-the-Green, in moss (*Rev. A. Matthews*).]

****Smicrus filicornis, Fairm.** Wolvercote Paper Mill, by sweeping, one, September 9th, 1919.

***Nephanes titan, Newm.** Headington, in refuse, Spring, 1915 (*H.B.*); Summertown, common in manure-heaps.

[****Ptilium brevicolle, Matth.** Weston-on-the-Green, unique (*Rev. A. Matthews*).]

***P. spencei, All.** In débris of wasp-nest, Wytham Park; plentiful, October 12th and 14th, 1920.

***Millidium trisulcatum, Aubé.** In manure-heap, Summertown; not rare, May, 1918.

***Ptenidium punctatum, Gyll.** In manure-heap, Marston Ferry Lane, rare, March 17th, 1917.

***P. brisouti, Matth.** Headington, in refuse (*H.B.*).

****P. (Wankowiezium) intermedium, Wank.** In a mole's nest, Yarnton, four examples, March 14th, 1915 (*J.C.*).

Family Corylophidæ.

***Orthoperus kluki, Wank.** Wytham Park, scarce (*J.C.*).

***O. corticalis, Redt.** Rather widely distributed; Godstow, Kirtlington, Besselsleigh, &c. (*J.C.*).

***O. punctatulus, Matth.** Headington (*H.B.*).

***Corylophus sublævipennis, Duv.** Enslow Bridge, 1910; King's Weir, in flood-refuse, February, 1920 (*J.C.*).

[Family **Sphaeriidæ.**]

[****Sphærius acaroides, Waltl.** First taken in Britain at Weston-on-the-Green in 1845 (*Rev. A. Matthews*). I have not myself met with it.]

Family **Coccinellidæ.**

****Scymnus arcuatus, Rossi.** Beaten very sparingly from old ivy on the walls of Godstow Nunnery; first taken July 30th, 1915.

Family **Erotylidæ.**

Triplax russica, L. In *Polyporus* on elm, Hitch Copse, Cothill; one example, July 13th, 1918.

Family **Colydiidæ.**

****Synchita juglandis, F.** A single living example of this rare species was found in a spider's web on a dead birch tree in Tubney Wood, June 12th, 1915.

***Cerylon fagi, Bris.** In old beech stump, singly, Wytham Park, February 18th, 1920.

***C. ferrugineum, Steph.** Tubney Wood, under bark of dead birch, one, June 19th, 1915.

Family **Histeridæ.**

***Paromalus flavicornis, Herbst.** Tubney, under oak bark, one, October 10th, 1915 (*J.C.*); Wytham Park, under ash bark, one, February 9th, 1918.

Family **Nitidulidæ.**

Carpophilus mutilatus, Er. I have recently found this species on several occasions in dates, in company with *C. hemipterus,* L., and *Silvanus mercator,* Fauvel.

Meligethes memnonius, Er. In *Lamium* and other Labiate flowers; not rare, and generally distributed.

***M. viduatus, Sturm.** In small Composite flowers in summer; Tubney, not rare.

M. flavipes, Sturm. Wood Eaton, June, 1907 (*J.C.*); not rare in Labiate flowers.

***M. rotundicollis, Bris.** By sweeping in early summer; Tubney, Wytham Park, &c, scarce.

Family **Monotomidæ.**

Monotoma brevicollis, Aubé. In dry dung near Headington, several, August 24th, 1914. Not uncommon in manure-heaps.

Family **Lathridiidæ.**

****Coninomus constrictus, Gyll.** In débris of nest of the ant *Acanthomyops* (*Lasius*) *fuliginosa,* Latr., near Tubney; rare, July 31st, 1920.

****Cartodere filum, Aubé.** Found sparingly in the herbarium of the School of Rural Economy in 1918 (*Mr. Williamson*).

***Corticaria fenestralis, L.** Oxford University Museum, in a window; one specimen, July 23rd, 1919.

Family **Cryptophagidæ.**

Cryptophagus hirtulus, Kr. Headington (*H.B.*) Apparently widely distributed.

****C. fumatus Gyll.** This rare species was first taken by Mr. H. G. Champion at Weston-on-the-Green, September 16th, 1912. It was found in the University Museum, June 14th, 1915, and on a few subsequent occasions by Mr. Collins and myself; and I have taken single specimens with *Acanthomyops fuliginosa*, Latr., near Tubney, July 26th, 1919, and August 13th, 1920.

****Atomaria wollastoni, Sharp.** By sweeping under hedges near Marston Ferry; one example, May 12th, 1919.

****A. zetterstedti, Zett.** This interesting addition to the British Coleopterous fauna was first taken by Mr. J. Collins in April, 1914, by beating old sallow-blossoms at Weston-on the-Green; and subsequently, May, 1918, at Yarnton, when I have taken it freely in his company. *Cf.* Entom. Mo. Mag., 1918, pp. 155-6.

Family **Scarabaeidæ.**

[***Aphodius lividus, Ol.** One specimen taken on the wing, Kirtlington Belt, September 16th, 1912.]

Family **Elateridæ.**

***Corymbites cupreus, F.** A female example picked up in Broad Street, Oxford, June 8th, 1915. Also taken on Shotover Hill by Mr. Britten.

Family **Telephoridæ.**

[***Silis ruficollis, F.** Occurs sparingly on reeds at Weston-on-the-Green in July.]

Family **Sphindidæ.**

***Sphindus dubius, Gyll.** Wytham Park, in snuff-like fungus on rotten beech logs, July 5th, 1915, subsequently found in plenty.

Family **Cissidæ.**

***Ennearthron affine, Gyll.** In hard white fungus on beech stumps, Wytham Park, not rare; first found July 5th, 1915.

Family **Prionidæ.**

***Prionus coriarius, L.** Remains of this conspicuous beetle were found at the foot of a dead birch-tree in Tubney Wood, November 20th, 1915; and two living examples, both males, were taken there, August 20th, 1917, and July 31st, 1919.

Family **Bruchidæ.**

Bruchus villosus, F. On flowers of broom at Foxcombe Hill; not rare, May 16th, 1918.

Family **Chrysomelidæ.**

***Donacia cinerea, Herbst.** King's Weir, on *Glyceria aquatica*; one specimen, June 15th, 1915.

***Luperus nigrofasciatus, Goeze.** Open Brazenose, on furze; one specimen, September 23rd, 1916 (*H.B*).

Longitarsus suturalis, Mars. Wytham Park, one example, October 6th, 1912 (*J.C.*).

[**Apteropeda globosa, Ill.** By sweeping in Abel Wood, near Hanborough Station; one specimen, May 14th, 1920.]

Family Tenebrionidæ.

*Alphitobius diaperinus, Panz.** In damaged maize, Cothill Mill, rare, November 20th, 1915; found in abundance at the bone-works, Eynsham Mill, August 6th, 1920.

*Palorus ratzeburgi, Wiss.** Cothill Mill, with the preceding species; abundant, November 20th, 1915.

Family Melandryidæ.

*Hallomenus humeralis, Panz.** By evening sweeping near Water Eaton; one specimen, June 18th, 1915.

Family Mordellidæ.

*Mordellistena parvula Gyll.**, var. **inæqualis, Mus.** On *Artemisia vulgaris*; Tubney, one specimen, Summer, 1918 (*J.C.*).

*Anaspis rufilabris, Gyll.** In rotten oak wood; Wytham Park, several, September, 1919 (*J.C.*).

Family Curculionidæ.

*Rhynchites pauxillus, Germ.** Hell Coppice, near Stanton St. John; one example, May 22nd, 1920.

*Apion desideratum, Sharp.** Most of the specimens recorded as *A. cruentatum,* Walt., are to be referred to this species. The true *A. cruentatum* occurs rarely at Tubney, where *A. hœmatodes,* Kirby, var. *brachypterum,* Sharp, is also found.

*A. waltoni, Steph.** Near Bayswater Mill, locally common on *Anthyllis, Helianthemum,* &c.; first taken August 24th, 1914.

Otiorrhynchus porcatus, F. A specimen of this recent introduction to the British list of *Coleoptera* was taken at Summertown by Mr. H. E. Gray, June 28th, 1918 (J. Collins, Ent. Mo. Mag., 1918, p. 209).

[*Tropiphorus carinatus, Müll.** Abel Wood, near Hanborough Station; two examples by sweeping, May 14th, 1920.]

*Orchestes pratensis, Germ.** By sweeping at Hell Coppice, not rare; first taken July 3rd, 1918.

*Pseudostyphlus pilumnus, Gyll.** Under *Matricaria inodora,* Sunnymead allotments, 1918, rare, July, 1915 (*J.C.*).

*Dorytomus validirostris, Gyll.** Shotover Hill, by sweeping; one specimen, May 4th, 1918.

[**Acalyptus carpini F.**, var. **rufipennis, Gyll.** This rare and interesting little weevil was first found singly in vegetable refuse at the Peat-pits, Weston-on-the-Green, March 17th, 1913; and sparingly on April 17th, by beating sallows in bloom. It has been obtained in large numbers by the same method in succeeding years, and has also been taken freely by sweeping, July 18th, 1914]

[*Miarus graminis, Gyll.** In flowers of *Campanula glomerata* at Stocky Bottom, near Stonesfield; plentiful, August 15th, 1915.]

Ceuthorrhynchus rapæ, Gyll. This fine and rare species was taken by Mr. J. Collins on *Sisymbrium officinale* at Godstow, August, 1918; and has occurred there very sparingly in the same month in succeeding years.

*C. **triangulum, Boh.** On *Achillea Millefolium* at Foxcombe Hill, rare, May 18th, 1916; Shotover Hill, not uncommon on the same plant.

***Ceuthorrhynchidius rufulus, Duf.** By sweeping at Godstow, August 23rd, 1919, and at Tubney, September 25th, 1920; single examples in both cases.

***Phytobius canaliculatus, Fahr.** Taken rarely by Mr. A. J. Chitty at Shotover Hill, May, 1907.

FAMILY **Scolytidæ.**

***Cryphalus binodulus, Ratz.** Cothill, by beating *Populus cinerea*; rare, July 20th, 1916.

[****C. abietis, Ratz.** Kirtlington Belt, by sweeping under spruce firs; four examples, May 3rd, 1909.]

Abnormal Coleoptera.

Stylops melittæ, Kirby. Host, **Andrena nigroænea, Kirby.** Male and female sometimes abundant in University Parks; also at Boar's Hill and Shotover.

S. wilkellæ, Perkins. Host, **Andrena wilkella, Kirby.** Generally abundant in the University Parks and Museum grounds (*A.H.H.*).

S. hammella, Perkins. Host, **Andrena chrysosceles, Kirby.** Shotover Hill, Boar's Hill, Sandford (*A.H.H.*).

S. spencii, Pickering. Host, **Andrena tibialis, Kirby.** Shotover Hill (*A.H.H.*).

S. aterrima, Newport. Host, **Andrena trimmerana, Kirby.** Boar's Hill, not uncommon.

S dalii, Curtis. Host, **Andrena labialis, Kirby. Boar's Hill, rare,** (*A.H.H.*).

S. spretæ, Perkins. Hosts, **Andrena spreta, Pérez,** and (?) **A. minutula, Kirby.** Oxford, Shotover Hill (?) (*A.H.H.*).

Halictoxenus spencii, Nassanov. Host, **Halictus nitidiusculus, Kirby.** University Parks, June 16th, 1902 (*A.H.H.*).

31st December, 1920.

HOLYWELL PRESS, ALFRED STREET.

From the Annals and Magazine of Natural History
Ser. 8, vol. xii., *September* 1913.

Brief Descriptions of new Thysanoptera.—I. By Richard S. Bagnall, F.L.S., F.E.S. (Hope Department of Zoology, University Museum, Oxford).

In this series of papers I propose to shortly describe new Thysanoptera, or thrips, from various parts of the world, though the collections in my hands at present are chiefly from Africa and India. This material, for which my hearty thanks is due, has been received from many sources, which I will more particularly mention in several larger contributions now in preparation.

I am especially anxious to have material from Australia, Japan, Asia (particularly from the north and west), Central and South Africa, South America, and the Polynesian and other groups of islands.

Suborder Terebrantia.

Family **Thripidæ**.

Retithrips bicolor, sp. n. (Vine thrips).

♀.—Length about 1·6 mm.

Rich golden-yellow, tinged lightly with brown; head, mesothorax, and metathorax (the latter anteriorly and laterally only) dark brown; legs yellow and antennæ light lemon-yellow. Sculpture and reticulation very strong. Vertex of head broadly raised, arcuate, with a median break; cheeks converging from behind eyes, slightly sinuate. Maxillary palpi apparently 4-jointed, the basal joint as long as the other three (? or two) together. Antennæ set below vertex, distant at base, very slender, and more than twice as long as the head; joints 3 to 6 more or less claviform; 3 as long as the two basal joints together, 4 slightly shorter than 3, and 5 and 6 about two-thirds (·66) the length of 4. Prothorax shorter than the head. Wings with cilia (which are smoky brown) on lower margins only; lower wing with dark median vein from base to apex.

In my two preparations with wings expanded I have been, as yet, unable to make out any arrangement of spines.

♂.—Length 1·15 mm.

Abdominal sternites 3 to 7 (? 2 to 6) with a roundish pale depression. Tenth abdominal segment with a pair of stout lateral bristles, which are apically strongly flattened out in the form of a broad **V**, with the apex truncate.

Hab. Ceylon, on vine (*E. E. Green*).

Readily separated from *Retithrips ægypticus*, Marchal, by its coloration, the long slender antennæ, and the shape of joints 3 to 6, and the longer and more slender wings. Dr. Marchal does not describe any special characteristics of the ♂ *ægypticus.*

Heliothrips indicus, sp. n.

♀.—Length 1·2 mm.

In *fasciatus*, *fasciapennis*, and *phaseoli* group, but readily distinguished by the male characteristics. Type of coloration (except wings) and form of antennæ as in *fasciatus.* Maxillary palpi two-segmented. Wings overreaching tip of abdomen; fore-wings white, tinged with grey at base, second and third fourths wholly grey-brown, decidedly lighter in middle, though the colouring is not broken; apical fifth grey-brown. Venation as in *fasciapennis*; basal vein set with two basal spines and one near fork; upper vein (fused with costa) with two near fork and two near apex; lower vein with five or six (usually $2+3+1$) more or less regularly placed spines.

♂.—Length 1·0 mm.

Ninth tergite with six rather long dorsal spines, one set on each side of the mid-line at a little distance from the posterior margin, and the other four in a line (but the inner pair set wider apart than the first-named pair) near the posterior margin. Abdominal sternites 3 to 7 with a strongly transverse pale area or depression, more or less arcuate, gradually lessening in size from the fourth to the seventh segment, the former being about fifteen and the latter eight times as wide as long. In *cinctipennis,* Hood, these pale areas are almost round, in *fasciatus*, Perg., they are transversely ovate, whilst in *fasciapennis*, Hinds, and *phaseoli*, Hood, they are transverse, but only five and nine times as long as wide respectively, and not arcuate.

Hab. INDIA: Sirsiah, Bengal, in numbers on indigo, 1908; and Surat, Bengal, on onions, berseem, and brinjal, February 1909 (*Maxwell Lefroy*).

Euthrips (*Anaphothrips*) *alternans*, sp. n. (Maize thrips).

♀.—Length 1·3 to 1·4 mm.

Head and first two abdominal segments dark grey-brown; pterothorax yellowish-brown to grey-brown; abdominal segments 7 to 10 dark chestnut-brown, 6 generally a similar or lighter chestnut-brown; prothorax, legs, and abdominal segments 3 to 5 yellow, at most lightly tinged with grey.

Antennal joint 1 light grey-brown; 2 darker brown, concolorous with the head; 3 clear lemon-yellow; 4 also yellow, but slightly deeper, and in some specimens tinged lightly with grey; 5 (except base, which is light) to 8 chestnut-brown. Wings very light grey; a dark greyish-brown patch across each fore wing from the basal fifth to about the middle; hind vein with dark median vein extending almost to tip.

Head as long as, or very slightly longer than, broad, about as long as the prothorax, and 0·5 the length of the antennæ. Antennal joint 6 not divided; prothorax without setæ at posterior angles. Wings broad near base, a few spines on both upper and lower veins of fore wing, irregularly placed and inconspicuous.

Hab. EGYPT: Bahteem, near Cairo, May 1st, 1911, common on maize (*F. C. Willcocks*).

E. alternans closely approaches *E. sudanensis* (Tryb.), but is sharply distinguished by the lighter basal joint of antennæ, the yellow prothorax, and the long head. It is also a larger insect.

Physothrips lefroyi, sp. n. (Tea-flower thrips).

A very distinctive species.

♀.—Length 1·4 to 1·7 mm.

Yellowish-white, lemon-yellow to yellow in darker specimens; bristles, cilia of wings, and antennal joints 2, 4, and 6 rich reddish brown. Antennal joint 4 basally yellow, and 5 only lightly tinged with reddish brown. Relative length of joints 3 to 8 as follows:—26 : 26 : 21 : 21 : 3 : 5.

Spines in upper vein of fore wing $2+3$ near base, 1 near middle, and 2 in distal third. Apical abdominal spines long.

♂.—Slightly smaller. Ninth tergite with six stout dorsal spines; four moderately long, forming an obverse arc, and a pair of shorter and stouter ones placed on a higher plane and medianly within the circumference of the arc. Spines and cilia more lightly coloured and antennæ practically unicolorous.

Hab. INDIA: Lebong, Darjeeling, Bengal, in the flowers of tea, Feb. 6th, 1909 (*Maxwell Lefroy*).

Named in honour of Prof. Maxwell Lefroy.

Physothrips funtumiæ, sp. n. (Rubber thrips).

♀.—Length 1·45 to 1·6 mm.

Colour dark grey-brown; legs rather lighter and fore-tibiæ

yellowish-brown to yellowish-white at tips; intermediate (and usually hind) tibiæ yellowish-white at tips. Fore-wings and cilia smoky yellowish-brown, lighter at base. Eyes coarsely facetted, pilose. Relative lengths of antennal joints 3 to 8 as follows:—20 (with stem) : 20 : 16 : 21 : 4·5 : 7·5. Third broader than any of the succeeding joints; fifth and sixth rather slender. Prothoracic bristles at posterior angles 0·65 the length of the prothorax. Legs sparingly clothed with setæ. Upper vein of fore-wing with 3+3 spines in the basal half near base, and only two spines in the distal half, together near tip. Apical abdominal spines long.

♂.—Length 1·0 to 1·1 mm., and more slender than ♀.

Each of the sternites 3 to 7 with a strongly transverse pale depression near upper margin *, and numerous, more or less small, irregular (but inclined to be roundish) areas of a similar nature placed irregularly over the whole of the surface. Ninth tergite with four short, stout, dorsal spines in the form of an obverse arc, inner pair more apical and shorter than the outer pair. Colour lighter; third antennal joint yellowish-white and joints 4 to 6 also yellowish-white in their basal halves.

Hab. AFRICA: on rubber-trees (*Funtumia elastica*), Uganda and Southern Nigeria (from several correspondents).

Physothrips usitatus, sp. n.

♀.—Length 1·6 mm.

Near *P. sjöstedti* (Tryb.). Colour brown, third antennal joint yellowish-brown to greyish-yellow; fore-femora (in *sjöstedti* dark) yellow, lightly tinged with brown, especially on the outer margin; fore-tibiæ, all tarsi, and intermediate and hind-tibiæ at extreme apices yellow. Fore-wing lightly tinged with brown at extreme base; clear to basal third and thence brown to apex, with a lighter patch just before apex; mid-vein of hind-wing extending to apex, brown; all spines and cilia dark. Head almost as long as broad and not quite as long as prothorax. Interocular bristles long. Antennæ 2·5 times as long as the head; relative lengths of joints:—13 : 15 : 23 : 23 : 14 : 21 : 6 : 8. Double trichomes on joints 3 and 4 long and stout. Middle joint of maxillary palpi the shortest. Upper vein of fore-wing with three basal bristles, a series of 11 (10–13) commencing at about the first fourth and running to, or just into, the distal third, and 2 at extreme apex; lower vein with series of 13 (12–15) bristles com-

* These may be broken up into a line of smaller depressions.

mencing at basal third. Body elongate, only slightly broader than the pterothorax. Apical segment about 0·2 shorter than ninth abdominal segment; bristles long, nearly as long as the two apical segments together.

This species differs from both *sjöstedti* (Tryb.) and *variabilis*, sp. n., in the long series of bristles in the lower vein commencing at the basal third, instead of with the corresponding series of upper vein at the basal fourth.

Hab. INDIA: Allahabad, in flowers of *Butea frondosa* (*A. D. Imms*).

Physothrips variabilis, sp. n.

♀.—Length 1·1 to 1·6 mm.

Near *sjöstedti* (Tryb.) and *usitatus*, sp. n., but broader. Dark specimens dark chestnut-brown; third antennal joint yellow; fore-tibiæ yellowish; intermediate and hind-tibiæ grey-brown; all tarsi yellowish. Light specimens light-grey to yellowish-brown; pterothorax lighter and abdominal segments 1 to 7 yellowish, only slightly tinged with grey-brown. Fore-wings and cilia light greyish-yellow, a lighter patch near apex; basal third clear. Upper vein with three basal spines, a series of 9 to 14 commencing at about the first fourth, and running well into the distal fourth on to the distal fifth; 2 at extreme apex. Spines of lower vein commencing also at the distal fourth. Head transverse, shorter than prothorax; eyes pilose. Relative lengths of antennal joints 3 to 8:—23 : 24 : 16 : 24 : 5 : 6. Double trichomes on segments 3 and 4 very large. Abdominal bristles long. Legs sparingly spinose.

Differs from *sjöstedti* (Tryb.) and *usitatus*, sp. n., by the broad form and transverse head and by the long series of spines in the upper vein of fore-wing extending to beyond the basal fourth.

Hab. COMORO ISLANDS?: "R. Oberthür, Coll. Marie. Mayotte?" (Leyden Museum).

Thrips assimilis, sp. n.

♀.—Length 1·1 mm.

Closely resembles *T. albopilosus*, Uzel, but is larger and differs in the following particulars:—Relative lengths of antennal joints 3 to 7:—18 : 15 : 12 : 18 : 6; 5 distinctly shorter than 4 and 5 and 6 both broader than 3 or 4. Upper vein in fore-wing with 12 bristles, viz. 6 + 1 in basal half and 5, more or less regularly placed, in distal half.

Hab. TUNIS: Sousse, 1 ♀, Feb. 28th, 1903 (*Biro*).

Suborder TUBULIFERA.

Family **Phlœothripidæ.**

Compsothrips reuteri, sp. n.*

♀.—Length about 2·0 mm.

Dark chestnut-brown, including legs and tarsi. Basal antennal joint brown; 2 shaded to yellow apically; 3 clear yellowish-white; 4 to 6 yellow, with 5 lightly and 6 more strongly shaded with brown apically; 7 brown and 8 yellowish-brown, lighter than 7. Head about 2·5 times as long as the prothorax, and 1·75 as long as broad behind eyes; cheeks slightly arcuate at about the posterior third. Pterothorax slightly longer than broad. Abdomen oblong-ovate, sharply narrowed from segment 8 to base of tube. Tube about 0·6 the length of the head and less than half (0·5) as broad at apex as at base. Legs long.

Resembles *C.* (*Leurothrips*) *linearis* (Bagn.) in type of coloration, but may be recognized by its smaller size, broader, more ovate, and shorter body, and the relatively longer head and legs.

Hab. EGYPT: Suez, 1 ♀, Aug. 4th, 1902 (*Biro*).

Cryptothrips trybomi, sp. n.†

♂.—Winged; length just over 2·0 mm.

Colour chestnut-brown, head yellowish brown, and tip of tube lighter; all legs yellow, wings tinged lemon-yellow; antennæ yellowish-brown, joint 3 lemon-yellow and 4 a deeper yellow. Head about 1·6 times as long as broad and 2·2 as long as the prothorax. Mouth-cone broadly rounded, extending to mesosternum. Eyes rather small, vertex raised. Ocelli large; postocular bristles present. Antennæ 1·75 times as long as head, joints 3 and 4 mildly claviform, and 5 and 6 elongate-fusiform, almost cylindrical. Prothorax strongly transverse, 2·5 times as wide through middle as long; all bristles present, long and light-coloured. Legs long. Nine cilia near apex of fore wing duplicated. Abdomen elongate; tube 0·6 the length of the head.

Hab. GERMAN EAST AFRICA: Moschi, Aug. 15th, 1905, 1 ♂ (*C. Katona*).

Easily distinguished by its type of coloration and by the unusual form of the antennal joints 5 and 6.

* Named in honour of Prof. O. M. Reuter, Helsingfors.

† Named in honour of the late Dr. Filip Trybom of Stockholm.

Cryptothrips citricornis, sp. n.

♂.—Forma *aptera.*

Length about 2·5 mm.

Elongate and linear. Colour chestnut to grey-brown; metathorax and abdominal segments 1 to 7 lighter, tinged with yellow. Antennæ yellow, sixth joint very faintly and the penultimate and apical joints tinged with grey; all femora grey-brown, with the extreme apices faintly yellowish; all tibiæ and tarsi lemon-yellow. Hypodermal pigmentation deep and widely diffused.

Head almost as in *icarus*, Uz., not quite 1·5 as long as broad just behind the eyes (where it is broadest), and nearly twice as long as the prothorax, which is strongly transverse. Ocelli moderately large, remote from inner margins of eyes. Postocular and all prothoracic setæ well developed, yellow. Wings and wing-retaining spines absent. Tube about 0·65 the length of the head and 2·3 times as long as broad at base. Apical bristles nearly as long as tube.

Related to *icarus*, Uz., from which it may be distinguished by its larger size, more elongated body, and also by its yellow antennæ, and the dark femora and light yellow tibiæ.

Hab. GERMAN EAST AFRICA: Arusha, Oct. and Nov., 1905 (*C. Katona*).

Haplothrips karnyi, sp. n.*

♀.—Length about 1·9 mm.

Colour dark grey-brown; crimson hypodermal pigmentation widely diffused; fore-tibiæ yellowish. Antennal joints 3 to 5 light yellow; 6 also yellow, tinged with light greyish-brown apically; 7 yellowish grey-brown, and 8 darker brown. Wings with a smoky tinge. Head and prothorax almost as in *kilimandjaricus* (Tryb.); head 1·35 as long as broad and about 1·5 times as long as the prothorax. Postocular and all prothoracic setæ long and stout, knobbed. Mouth-cone reaching a little more than halfway across prosternum. Prothorax 1·6 broader than long. Fore-tarsus with a small tooth. Posterior margin of fore-wing with seven cilia duplicated near apex. Tube 0·6 the length of head; abdominal bristles long and moderately stout, wing-retaining bristles stout.

H. karnyi comes nearest to *cahirensis* (Tryb.) and *kilimandjaricus* (Tryb.), differing from both in the more greatly developed postocular and prothoracic setæ, and in the long

* Named in honour of Dr. H. Karny of Elbogen.

abdominal bristles, those on segments 7 to 9 being nearly as long as the tube. It differs from *usitatus* (Bagn.) in this latter respect and also in the longer head and prothorax.

Hab. German East Africa; Arusha, Oct. and Nov., 1905 (*C. Katona*).

Haplothrips longisetis, sp. n.

♀.—Length about 1·75 mm.

Elongate and linear. Brown, first abdominal segments somewhat lighter; tube darker basally; femora grey-brown; tibiæ yellow, tinged with brown on the outer margin and basally; third antennal joint yellow, fourth rather lighter brown than the succeeding joints. Wings colourless, transparent, posterior margin of fore-wing with four cilia duplicated near apex. Head 1·14 as long as broad, about 1·25 as long as the prothorax, and about 0·6 the length of the antennæ. Mouth-cone very short and rounded. Prothorax 1·6 as broad as long; all setæ present, knobbed. Fore-tarsus with prominent tooth. Tube 0·58 the length of the head; apical setæ exceptionally long, 2·25 times as long as the tube; those on ninth abdominal segment 1·5 the length of the tube.

H. longisetis comes in the *aculeatus* group, but is readily recognized by the long apical abdominal hairs.

Hab. Alexandria: one example found in a dead twig of fig (*Ficus* sp.), March 6th, 1905.

Submitted by Mr. F. V. Theobald.

Haplothrips brevicollis, sp. n.

♀.—This species has the fore-tarsus unarmed and comes nearest to *cahirensis* (Tryb.). It may be separated from all the species in that group, however, by its very short and strongly transverse prothorax. The head is nearly 0·9 as broad as long and 1·85 times the length of the prothorax, which latter is 2·3 times as broad as long. The tube is 0·6 the length of the head. The posterior margin of the forewing has six cilia duplicated near the posterior margin.

Hab. Africa: Kibosho, 1903 (*Kittenberger*).

Hoplandrothrips hoodi, sp. n.*

Forma *macroptera*.—Length 1·2 to 1·5 mm.

Colour yellowish-brown to grey-brown; tube grey-brown,

* Named in honour of the American Thysanopterist, Mr. Douglas Hood.

darker near basal third and laterally. Antennæ with joints 1 to 3 yellow; 4 and 5 light brown, with basal thirds yellow; 6 light brown, with basal fourth yellow; 7 and 8 brown. All femora light brown, shaded to yellow apically; fore-tibiæ yellow, and intermediate and hind-tibiæ yellowish distally and basally. Hypodermal pigmentation thick.

Head twice as long as prothorax and about 1·25 times as long as wide; cheeks bulging behind eyes, and from thence converging to base. Eyes finely facetted; ocelli moderately large. Postocular bristles present, knobbed. Mouth-cone extending across prosternum. Antennæ more than twice as long as the head. Prothorax strongly transverse, 2·3 times as wide through middle as long; all bristles present, knobbed. Nine cilia near apex of fore-wing duplicated. Fore-legs stout and tarsi armed; fore-tibia in the ♂ with one tooth near base, and femur with two teeth near apex within; in the ♀ simple. Abdomen roundly narrowed from segment 6 to base of tube. Tube about 0·5 times the length of head. Apical bristles almost as long as tube. Abdominal bristles well-developed; segments 3 to 8 with one shorter stout pair and one straight knobbed pair.

Forma *aptera*.—Wings and wing-retaining spines absent.

Hab. German East Africa: Arusha, f. *macroptera*, 1 ♂, f. *aptera*, 1 ♂ and 1 ♀, Oct.–Nov., 1905 (*C. Katona*).

Trichothrips longicornis, sp. n.

Forma *aptera*.—Length about 1·6 mm.

Yellowish to chestnut-brown, head and abdomen generally darker; tube shaded to yellow at apex. Fore-tibia, at least apically, yellowish; basally and along the upper and lower margins dark brown. Antennæ with basal joint concolorous with head; 2 yellowish, tinged with brown basally; 3 to 6 clear lemon-yellow, 6 sometimes faintly tinged and 7 and 8 very lightly tinged with brown.

Head quadrate, only 0·08 longer than broad and about 1·5 times as long as the prothorax; cheeks parallel to basal fourth, then slightly narrowed posteriorly. Eyes well-developed; front ocellus facing forwards; postocular bristles long. Mouth-cone broadly rounded, not quite reaching across the prosternum. Antennæ about 2·2 times the length of head, set below vertex; relative lengths of antennal joints 3 to 8 as follows:—20 : 19 : 20 : 21 : 23 : 18; two apical joints slender.

Prothorax transverse, 0·5 as long as broad; pterothorax nearly as broad as the width across fore-coxæ, slightly

broader than long. Abdomen elongate, almost parallel to segment 7. Tube about 0·7 the length of the head. Abdominal spines pointed.

Nearest *T. femoralis*, Moulton, from which it may be distinguished by the shorter and more transverse prothorax, the relative lengths of the distal antennal joints, the shorter tube, and the colour of the fore-tibia and tube.

Hab. West Africa: Sierra Leone.

Numerous dried specimens in the British Museum.

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 8, Vol. xiii., *January* 1914.

Brief Descriptions of new Thysanoptera.—II. By RICHARD S. BAGNALL, F.L.S., F.E.S. (Hope Department of Zoology, University Museum, Oxford).

Suborder TEREBRANTIA.

Family **Thripidæ.**

Scirtothrips signipennis, sp. n.

♀.—Length 1·2 mm.

Light lemon-yellow, first antennal joint almost white, 5 distally very lightly tinged with grey, 6 with distal two-thirds (or thereabouts) and 7 and 8 wholly grey-brown. Fore-wings grey-brown, second and apical fifths white or light grey; hind-wings with middle brown, corresponding to the long dark patch of upper wing.

Head transverse, about 0·8 as long as broad. Eyes rather large and coarsely facetted, pigment very deep purplish black; ocelli with crimson crescentic margins. Antennæ twice as long as the head, slender; relative lengths of joints approximately:—16 : 22 : 32 : 30 : 32 : 32 : 7 : 13—1 and 2 much broader than any of the following, and 6 not divided. Double trichomes on 3 and 4 long and very slender. Mouth-cone short, brown at tip; maxillary palpi 3-jointed, joints 2 and 3 practically subequal in length.

Prothorax about as long as head and about 1·6 times as broad as long, surface sparsely and irregularly set with very minute setæ; one postero-marginal spine near each hind-angle, short, only 0·25 the length of prothorax. Legs somewhat stout, hind-tibia with a series of moderately fine spines on distal half within, and tarsus with a series of similar spines near apex. Pterothorax nearly 1·45 times as broad as the prothorax, and about as long as broad. Wings slender, reaching only to the sixth abdominal segment; cilia fuscous, those of hind margins very long; fore-wing with three minute, widely spaced setæ on distal half of upper vein, and lower vein with but four setæ. Hind-wing with median vein continued almost to apex, very prominent through dark area.

Abdomen elongate-ovate, dorsal surface finely and wavily striate, in parts reticulate; segments 9 and 10 with moderately long and rather fine bristles, 9 being furnished with a shorter dorsal pair which are somewhat widely separated.

This species somewhat closely resembles *Euthrips cingulatus,* Karny, from which it is easily separated by the prothoracic bristle at each hind-angle, the uniform light yellow colour of body, and the coloration of the antennæ. The coloration of the wings is about the same. The relative lengths of the antennal joints are also distinctive.

Type. In British Museum of Natural History.

Hab. CEYLON: Peradeniya, 1 ♀ taken by Mr. A. Rutherford from under leaf-sheaths of banana, 16. 6. 13 (Entomological Research Committee).

Pseudothrips glaucus, sp. n.

♀.—Length 0·95, breadth of mesothorax 0·28 mm.

General colour light grey-brown, apex of abdomen slightly darker; legs somewhat lighter than the body. Antennæ darker grey-brown, with joints 1 and 3 a little lighter. Wings greyish yellow.

Head transverse, about 0·65 as long as broad, practically as long as prothorax. Mouth-cone almost reaching across prosternum; palpi rather long. Antennæ more than twice as long as head; joint 3 pedicellate, 6 simple, not divided. Relative lengths of joints approximately:—10 : 22 : 27 : 24 : 22 : 26 : 5 : 8.

Prothorax 1·85 times as broad as long, one long and stout bristle near each hind-angle. Pterothorax large. Legs moderately long and stout. Wings long, reaching almost to tip of abdomen; upper vein of fore-wing with an unbroken series of 15–18, and lower vein with 13–15 setæ.

Abdomen elongate-ovate, posterior margin of eighth tergite fringed. Bristles at hind-margin of ninth tergite long, but those of tenth comparatively short, excepting a pair of long dorsal bristles.

This species is easily separated from *P. inequalis* (Beach) by its colour, the undivided sixth antennal joint (and relative lengths of joints), shorter prothorax, and presence of dorsal bristles on tenth abdominal segment.

Type. In Hope Collections, University Museum, Oxford.

Hab. Cape Town, 1 ♀ from *Sebæa* (*Dr. R. Marloth*).

Physothrips antennatus, sp. n.

♀.—Length 1·3 to 1·4 mm.

Colour dark brown, crimson hypodermal pigmentation

especially noticeable in thorax. Fore-femora basally and all tibiæ distally shaded to pale yellowish-white, all tarsi yellow. Basal half of third antennal joint light yellowish-brown and distal half (the constricted part) of both 3 and 4 lighter than the basal half. Wings grey-brown.

Head 0·8 as long as broad across eyes, and nearly as long as the prothorax; cheeks gently diverging to base. Antennæ 2·7 times as long as the head; relative lengths of joints 3–8 approximately:—38 : 56 : 30 : 40 : 7 : 13. Joint 4 curiously constricted and produced in the form of a stem distally.

Fore-wing with a series of 10 spines in upper vein, commencing at the basal fourth and extending to the distal third, and 2 at apex; lower vein with a series of 13, commencing just beyond the first bristle in the long series of upper vein.

Abdomen elongate, ninth segment with a pair of dorsal bristles in addition to the postero-marginal series.

This species comes near to *sjostedti* (Tryb.), *usitatus*, Bagn., and *variabilis*, Bagn., but is readily separated from these and all other described species of the genus by the long fourth antennal joint and its curious distal stem.

Type. In British Museum of Natural History.

Hab. Uganda (*C. C. Gowdey*). Mr. Gowdey writes that this species feeds on the spores of the coffee-fungus, *Hemeleia vastatrix.*

Thrips hololeucus, sp. n.

♀.—Length 1·0–1·2, breadth of mesothorax 0·27 mm.

Colour to the unaided eye white, under a moderate power from very light greyish-yellow to a deeper shade in dark specimens. Antennæ with the first joint white or colourless, 2–7 light greyish-brown, basal halves of 3 and 4 lighter, and 5 also lighter basally.

Head transverse, 1·37 times as broad as long, and not quite as long as the prothorax; posterior fourth faintly and irregularly transversely striate. Cheeks gently arcuate; mouth-cone pointed, reaching across prosternum, maxillary palpi long and slender, third joint the longest. Eyes occupying one-half the length of the head, coarsely facetted, pilose; pigmentation deep black. Ocelli with yellowish crescentic hypodermal pigmentation, a short curved seta on each side of the anterior one. A series of short dorsal setæ on an irregular line drawn behind the eyes. Antennæ with basal joints subapproximate, 2·25 times as long as the head; third

joint pedicellate; relative lengths of joints as follows:— 8 : 13 : 17 : 16 : 13 : 17 : 5—2 distinctly broader than any of the following, 5 and 6 somewhat broadly united; double trichomes on 3 and 4 slender and only moderately long.

Prothorax 1·5 times as broad as long, surface faintly and irregularly striate; the two bristles at each posterior angle from 0·3 to 0·34 as long as the prothorax, stout; a series of short postero-marginal setæ, of which the inmost pair is slightly the longest. Dorsal surface irregularly set with setæ. Pterothorax about as long as broad. All legs fairly long and stout, sparingly setose, setæ on the fore-margins of all tibiæ forwardly curved; hind tibiæ with series of short spines on distal third within. Wings reaching to ninth abdominal segment, faintly tinged greyish-yellow; cilia and spines dark. Costa and veins of fore-wing distinct; upper vein with a series of 4–5 basal setæ, 3 terminating at juncture with lower vein, then 4 widely and somewhat regularly spaced ones occupying the distal half; costa with 28 setæ, increasing in length distally, those towards the apex being as long or longer than the breadth of the wing; lower vein regularly set with 15–16 setæ. Cilia on fore-margins of both pairs somewhat sparse and widely spaced; on hind margin close, long, and wavy.

Abdomen elongate-ovate, about twice (or a little more) as long as broad; segments 2 and 3 the broadest, gently narrowing from 3 to 7 and thence more sharply to tip. Eighth tergite with a very fine fringe. Terminal bristles on 9 and 10 long and stout, about 1·5 times as long as the respective segments bearing them, and 9 with a pair of shorter dorsal bristles. Lateral abdominal bristles moderately long and stout, all light greyish-brown.

A distinctive species.

Type. In Hope Collections, University Museum, Oxford.
Hab. JAPAN: Kobe, July 1913 (*J. E. A. Lewis*).

Thrips albipes, sp. n.

♀.—Length 0·9 to 1·1, breadth of mesothorax 0·24 mm.

Head yellowish-white, with greyish-brown cheeks; prothorax golden-yellow; pterothorax also golden-yellow, but deeper and usually shaded with brown. Abdomen rich brown, first (and sometimes the second) segment lighter; all setæ dark. All legs yellowish-white or light lemon-yellow. Antennæ with first segment grey, 3 and sometimes extreme

base of 4 light lemon-yellow; 2 and 4 to 7 brown, 2 sometimes lighter distally. Fore-wings smoky-brown, basal fourth light.

Head almost as in *hololeucus*, about 1·25 times as broad as long, and about as long as the prothorax. Eyes as in *hololeucus*, pigmentation deep purplish-black; ocelli with crimson crescentic pigmentation. Mouth-cone not quite reaching across prosternum; maxillary palpi long, with middle joint the shortest; labial palpi long and slender. Antennæ about 2·3 times as long as the head; relative lengths of joints approximately:—7 : 12 : 17 : 16 : 12 : 17 : 5—2 broader than any of the following, 3 pedicellate, and 5 and 6 rather broadly jointed.

Prothorax 1·5 times as long as broad, with setæ as in *hololeucus*, dorsal surface not striated. Pterothorax about as broad as long. Legs as in *hololeucus*, hind-tibiæ shorter, with a series of short setæ on the distal half within. Wings reaching to the ninth abdominal segment, fore-wings about 15 times as long as broad across middle. Veins of fore-wing not distinct, upper vein with 3 widely-spaced setæ in distal half; lower vein with a series of 14 and costa 26 to 30 setæ. Cilia as in *hololeucus*. Hind-wing with a dark median vein to apex.

Abdomen ovate or, when segments are fully extended, elongate-ovate, apically rather sharply narrowed and pointed. Eighth tergite very finely fringed. Terminal bristles long, ninth segment with a pair of short widely-separated bristles (0·3 to 0·4 the length of the long ones), which are inwardly directed distally. Lateral abdominal bristles somewhat long.

Also a distinctive species.

Type. In Hope Collections, University Museum, Oxford.

Hab. JAPAN: Okinawa, Luchu Is., on nasturtium, May, and at Kobe, with *T. hololeucus*, sp. n., July 1913 (*J. E. A. Lewis*).

Suborder TUBULIFERA.

Docessissophothrips frontalis, sp. n.

Length about 5·5 mm.

Colour deep blackish-brown; fore-tibiæ light yellowish-brown, all tarsi dark yellowish-brown; wings smoky-brown, cilia darker. Antennæ absent in the unique example.

Head twice as long as broad, almost as in *D. major*, Bagn., but with the vertex produced into a prominent hump, with

the front margin truncate and having the anterior ocellus on the truncate plane facing forwards. The posterior three-fourths is dorsally gently and evenly arcuate, and the surface is irregularly and rather deeply furrowed dorso- and ventro-laterally. Cheeks set with numerous short setæ. Postocular bristles long and colourless; a second shorter and weaker pair set within the longer pair and on about the same line.

Docessissophothrips frontalis, sp. n. Head and prothorax viewed laterally, with right front leg.

Prothorax as in *D. major*, bristles at the anterior and posterior angles, together with mid-lateral and postero-marginal pairs, long, slender, and colourless; those on posterior margin the longest. Pterothorax as broad as width across the fore-coxæ and only slightly longer than broad. Wings reaching to the eighth abdominal segment. Fore-femora and tibiæ apparently without the long conspicuous bristles seen in *D. major*; inner margin of fore-tibiæ with numerous rather long setæ (as long as the breadth of the tibia).

Abdomen elongate, gently and roundly narrowed from seventh segment to base of tube. Tube about 0·65 the length of the head, terminal hairs very weak, about 0·7 as long as tube, colourless distally. Bristles on ninth segment about as long as the tube, colourless; other lateral abdominal bristles moderately long, faintly tinged with yellow, or colourless.

Type. In Hope Collections, University Museum, Oxford.

Hab. JAPAN: one example collected by Mr. John E. A. Lewis.

Androthrips flavipes, sp. n.

♂.—Length about 2·3 mm.

Thorax and abdomen dark grey- to blackish-brown, the former a little less deep in colour; head yellowish-brown, with

cheeks dark greyish-brown. All legs (excepting coxæ) yellow. Antennæ with joints 1 and 2 dark brown, the latter lighter apically; 3 and 5 yellow, with very faint tinge of grey distally; 4 yellow, grey-brown near apex; 6 yellow, distinctly tinged with grey distally; and 7 and 8 light grey-brown.

Head approximately 1·2 times longer than broad and 1·5 times as long as the prothorax, sides parallel. Mouth-cone exceptionally short, maxillary palpi with second joint very long. Antennæ 1·55 times as long as the head, joints 3 and 4 much broader than any of the others. Relative lengths of joints approximately:—12 : 18 : 22 : 22 : 19 : 18 : 17 : 12.

Prothorax transverse, about twice as broad as long; bristles at posterior and anterior angles, and the mid-lateral and postero-marginal pairs present. The postero-marginal pair and those at posterior angles long, the latter 0·6 as long as the prothorax. Pterothorax transverse. Fore-femora strongly incrassate, with a stout, blunt, tooth-like projection at the base within, the inner margin straight and set with a few very minute "teeth." Fore-tarsus set with a stout, sharp, curved tooth.

Wings practically clear, rather broad; fore-wings apparently not constricted as in *Hoplothrips*, with 8–11 duplicated cilia.

Abdomen about as broad as the pterothorax, elongate, narrowing evenly from sixth segment to base of tube. Tube 0·6 the length of head, about twice as long as broad at base, and twice as broad at base as at apex. Terminal hairs longer than tube, but very slender (and difficult to see) distally, colourless, except near base. Lateral abdominal bristles long and slender, faintly knobbed; none so long as the tube.

Type. In the British Museum of Natural History.

Hab. CEYLON: Peradeniya, 1 ♂ taken by Mr. A. Rutherford from *Memexylon umbellatum*, 28. 6. 13 (Entomological Research Committee).

Gynaikothrips karnyi *, sp. n.

Length 1·9, breadth of mesothorax 0·42 mm.

Colour deep blackish-brown, thorax and distal half of tube not quite so dark; all tibiæ and tarsi light lemon-yellow, and antennal joints 3–8 lemon- to golden-yellow.

Head about 1·42 times as long as broad and practically

* Named in honour of Dr. H. Karny, who has done so much work on gall-thrips.

twice as long as the prothorax ; sides parallel. Mouth-cone reaching across prosternum, somewhat pointed. Eyes occupying about one-third the length of the head, finely facetted ; postocular bristles moderately long and stout. Vertex raised in form of a hump. Ocelli large. Antennæ 1·5 times as long as the head ; relative lengths of joints approximately :— 10 : 16 : 23 : 22 : 22 : 21 : 18 : 13—7 and 8 broadly jointed, 8 narrowly pyriform, pointed apically.

Prothorax very short and strongly transverse, at least 2·3 times as broad across posterior angles as long ; all bristles present, long and rather stout, pointed ; postero-marginal pair 0·8 as long as the prothorax. Pterothorax a little wider than width across fore-coxæ and as long as broad. Legs normally stout and long. Wings reaching to eighth abdominal segment, cilia smoky.

Abdomen about as broad as the pterothorax, gently narrowing from fifth segment. Tube 0·6 as long as the head, slightly more than twice as long as broad at base, and twice as broad at base as at apex. Terminal hairs coloured at base and continued as long colourless filaments, about 0·85 as long as the tube. Lateral abdominal bristles yellow, long and rather stout on segments 6–8 at least ; those on 9 particularly long and very slender (and indistinct) apically, up to 1·7 times the length of the tube.

Type. In the British Museum of Natural History.

Hab. CEYLON : Peradeniya, ex marginal leaf-galls of black pepper (*Piper nigrum*), A. Rutherford, 21. 7. 13 (Entomological Research Committee).

Œdemothrips (?) *brevicollis*, sp. n.

♀.—Length 1·9, breadth of mesothorax 0·4 mm.

Colour of abdomen black, first segment brownish ; thorax grey-brown ; head yellow to yellowish-brown, cheeks darker. Antennæ with joints 1 and 2 yellow, 3–5 yellow, lightly shaded with grey, the fifth darker ; 6 chestnut-brown, rather lighter at base, and 7 and 8 dark blackish-brown.

Head only 0·9 as long as broad, and as long as the prothorax, cheeks feebly arcuate, converging towards base. Eyes occupying about 0·34 the length of head. Ocelli small, posterior pair widely separated, almost touching the inside margins of eyes. Postocular bristles about as long as the eye, and interocular pair only about 0·5 as long. Antennæ nearly twice as long as the head ; relative lengths of joints approximately : — 14 : 19 : 23 : 21 : 20 : 19 : 14 : 9. Joint 2 constricted near base, 3 clavate, 4 and 5 roughly

clavate, 6 with apex rather broadly truncate, and 7 and 8 broadly united.

Prothorax about 2·3 times as broad as long; bristles at hind-angles and the postero-marginal pair present, the first-named long, about 0·5 as long as prothorax. Pterothorax transverse, about 1·25 times as broad as long. Legs rather stout and long; each intermediate and hind-femur with a short stout seta on the outer margin beyond middle. Wings absent.

Abdomen elongate-ovate, 0·65 the total length of the insect, broadest at about fifth segment, where it is 1·4 times as broad as the mesothorax.

Tube stout, about 0·8 as long as the head, 1·75 times as long as broad at base and less than 0·5 as broad at apex as at base; terminal hairs short and weak, not quite 0·6 as long as the tube. Lateral abdominal bristles not long, but noticeably strong, especially those on segments 7–9.

Type. In Hope Collections, University Museum, Oxford.

Hab. JAPAN: Okinawa, Luchu Is., 1 ♀ collected by Mr. J. E. A. Lewis.

Trichothrips lewisi, sp. n.

♂.—Length about 1·45, breadth of mesothorax 0·285 mm. Colour lemon-yellow, antennæ very lightly tinged with grey; first two antennal joints, frons and cheeks, distal half of mesothorax, sides of pterothorax, first abdominal segment, and the anterior corners of segments 2–8 shaded with grey-brown.

Head 1·1 times as long as broad and 1·3 as long as the prothorax. Cheeks constricted behind eyes and near base. Eyes prominent, occupying 0·35 the length of the head, widely separated. Ocelli rather large, posterior ones well apart from inner margins of the eyes. Postocular bristles long and slender; interocular pair rather short. Mouth-cone blunt, broadly rounded at apex, reaching a little more than halfway across prosternum. Antennæ twice as long as the head; relative lengths of joints as follows:—13 : 14 : 20 : 16 : 16 : 16 : 13·5 : 16; apical joint narrowly pyriform.

Prothorax trapezoidal, twice as broad across hind-angles as long, with a distinct median line; mid-lateral, postero-marginal bristles, and pair at hind-angles present, long and slender, the postero-marginal pair the longest. Pterothorax about as long as broad; wings reduced, narrow and vestigial in character, reaching to hind-margin of first abdominal segment. Legs moderately long and stout; fore-femur

incrassate, fore-tibia stout, and tarsus armed with a sharp broad tooth, and also with a hidden curved tooth near apex.

Abdomen only slightly broader than the pterothorax, practically subparallel to seventh segment, and thence gently rounded to base of tube; well-developed wing-retaining bristles on segments 2–6. Tube about 0·6 the length of head, 1·6 times as long as broad near base, and about 0·4 as broad at apex as at base, evenly narrowed from base to tip. Terminal hairs about as long as the tube, slender. Lateral abdominal bristles long and slender on segments 1 to 9, mostly as long as or longer than tube.

A very distinct species of the group characterized by the short mouth-cone, and readily recognized by the form of the head, the relative lengths of the antennal joints, and the distinctive type of coloration. I have pleasure in naming the species in honour of its discoverer.

Type. In Hope Collections, University Museum, Oxford.

Hab. JAPAN: Okinawa, Luchu Is., 1 ♂, collected by Mr. J. E. A. Lewis, May 1913.

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser 8, Vol. xiii., *March* 1914.

Brief Descriptions of new Thysanoptera.—III. By RICHARD S. BAGNALL, F.L.S., F.E.S. (Hope Department of Zoology, University Museum, Oxford).

Suborder TEREBRANTIA.

Family Æolothripidæ.

Orothrips australis, sp. n.

Colour dark grey-brown; hind legs, including tarsus, unicolorous with body (other legs absent in the type specimen). Mouth-cone rather long, reaching across prosternum; maxillary palpus 7-jointed; labial 3 (?)-jointed. Antennæ dark grey-brown, apex of joint 2 and whole of 3 excepting distal third yellowish-white, extreme base of 4 yellowish-brown; relative lengths of joints approximately:—32 : 60 : 104 : 82 : 52 : 32 : 19 : 12 — joint 3 pedicellate. Very narrow, wavy, elongated, membranous sense-areas in 3 and 4; a short, straight, but otherwise similar area in 4; and a minute sense-cone on each of the joints 5, 6, and 7.

Fore-wings longer and narrower than in *kelloggii*, Moulton, clear white with extreme base and a band across tip dark brown, and a similar but more extensive dark band across middle; setæ along costa and the longitudinal veins minute; cilia of hind fringe up to more than 2·5 times as long as the greatest breadth of wing. All cross-veins included well within the central dark area. Hind-wings with light grey patches corresponding with the dark areas of fore-wings.

Abdominal segment 8 without the pair of stout spines described in *kelloggii*, 9 and 10 with moderately long bristles; tergite 9 about twice as long as 10.

Differs from *O. kelloggii*, Moulton, in the colour and relative lengths of the antennal joints, the longer mouth-cone, and fewer (?) joints in labial palpi; the longer, narrower fore-wings with more extensive dark central area, more minute setæ, and longer cilia; and the lightly banded hind wings.

Moulton says that the labial palpi of *O. kelloggii* are 4-jointed in his key to genera, but 5-jointed in describing the genus and species.

Type. In Hope Collections, University Museum, Oxford.

Hab. AUSTRALIA: one ♀ collected by Mr. A. Eland Shaw from the flowers of a native shrub, *Xanthorrhœa australis*, Healesville, Victoria, Oct. 12, 1913.

Family **Thripidæ**.

Thrips japonicus, sp. n.

A very distinct species.

♀.—Length about 1·4, breadth of mesothorax 0·3 mm.

Colour yellow, lightly tinged with grey, legs lighter and thorax orange-yellow; setæ dark. Abdominal segments 9 and 10 entirely dark grey-brown, almost black, and all *tergites* lighter or darker grey-brown. Antennal joints 1 and 3 dirty yellowish-white, 2 orange-yellow, 4–7 dark grey-brown, 5 in some specimens more or less yellowish basally. Fore-wings and cilia grey, lighter basally.

Head about 0·75 as long as broad and 0·8 as long as the prothorax; eyes coarsely facetted, pilose, black. Relative lengths of antennal joints 2–7 as follows:—24 : 34 : 32 : 22 : 31 : 7 — 3 pedicellate, and 3 and 4 fusiform.

Prothorax about 1·5 times as broad as long, surface sparsely setose; bristles at posterior angles about 0·4 the length of prothorax. Wings reaching to about the ninth abdominal segment, upper vein of fore-wing with 3 (approximately 1 + 1 + 1) setæ in the distal half.

Abdomen elongated, no broader than pterothorax, with segments 9 and 10 sharply narrowed to tip; 10 divided above.

Type. In Hope Collections, University Museum, Oxford.

Hab. Kobe, Japan, not uncommon, Nov. 1913 (*J. E. A. Lewis*).

Suborder TUBULIFERA.

Family **Idolothripidæ**.

Dicaiothrips stenocephalus, sp. n.

♂.—Length 4·7, breadth of mesothorax 0·72 mm.

Dark brown, including all femora, tibiæ, and tarsi (excepting the fore-tarsi, which are yellowish). Antennal joint 3 light lemon-yellow, brown at apex; basal half of 4, except a narrow ring at extreme base, light yellow, and basal third of 5 yellowish-brown.

Head exceptionally long and slender, 3·3 times as long as broad at broadest; vertex produced; eyes occupying less than 0·2 the length of head; postocular and anteocular bristles long. Antennæ 1·4 times as long as the head, relative lengths of joints 3–8 approximately:—67 : 59 : 50 : 35 : 23 : 22. Mouth-cone very small and short.

Prothorax about 0·4 the length of head. Fore-femur

stout, a basal series of very stout dark spines on outer margin in addition to the usual bristles, and a yellow sickle-formed bristle at apex; fore-tibia very short and stout; tarsal tooth rather short.

Tube 0·68 as long as the head, slender; terminal hairs colourless, 0·65 the length of tube and those on tergite 9 not quite as long as tube.

Recognized by the long and slender head.

Hab. GERMAN EAST AFRICA: Moschi, 1 ♂ collected by Mr. C. Katona, Aug. 15, 1905 (National Hungarian Museum).

Dicaiothrips proximus, sp. n.

♂. Near *malayensis*, Bagn., a little longer and much stouter. Anterior femora very greatly enlarged, with a brown sickle-shaped bristle at apex. Head with vertex less noticeably prolonged; postocular bristles present. Antennal joints 3 and 4 subequal; 4 with basal third, and 5 basally yellowish. Prothorax much larger than in *malayensis*, not quite 0·5 the length of the head; disc sloping from basal margin, which is raised. Tube about 0·75 the length of head and longer than either of the abdominal segments 7 or 8; two stout spines on ninth sternite.

Type. In Hope Collections, University Museum, Oxford.

Hab. CEYLON: Peradeniya, 1 ♂ (in association with what is probably the ♀ of the species), from pods of *Crotalaria* sp., November 1912 (*E. E. Green*, No. 3180).

Dicaiothrips greeni, sp. n.

Length 7·2 mm.

This species comes in my first division of the genus, in which the head is produced beyond the eyes for at least the length of the eye and for more than the width at the base of the produced part.

Colour dark brownish-black; fore-tibiæ yellowish-brown; intermediate tibiæ brown, lighter at both ends; hind-tibiæ light at base, and shading to yellow distally. Antennæ with joint 3 yellow, brown at apex, basal half of 4 and third of 5 shaded to a light brown.

Head nearly 3·5 times as long as broad near base, the produced part occupying about 0·25 and the eyes 0·2 the total length. Postocular bristles long, and a second pair of dorsal bristles near basal fourth as in *Anactinothrips*, Bagn.,

and *Dracothrips*, nov.* Antennæ moderately slender, fourth joint about 0·8 the length of third. Cheeks rather closely set with long and short setæ, somewhat as in *D. grandis*, Bagn.

Prothorax about 0·4 the length of head, setæ only moderately long, those at anterior angles directed forwards. Fore-femora incrassate, with numerous outer marginal setæ, including several unequal-sized longer ones, much as in *D. championi*, Bagn.; setæ light-coloured, a slender sickle-shaped brown spine at apex. Tarsal tooth long and sharp. Hind-legs very long and slender. Wings reaching to the fifth abdominal segment.

Abdomen long, segment 8 a little longer than 7. Tube slender, about 0·75 the length of the head and as long or a little longer than the seventh segment. Terminal bristles 0·8 the length and those on 9 almost as long as the tube.

Type. Hope Collections, University Museum, Oxford.

Hab. CEYLON: Peradeniya, 1 ♂ taken in association with another *Dicaiothrips* not yet determined, from decayed pods of *Phaseolus* sp. (*E. E. Green*, No. 3023). I have pleasure in naming the species in honour of its well-known discoverer, to whom I am indebted for much interesting material and information.

Genus DRACOTHRIPS, nov.

Near *Mecynothrips*, Bagn. Head widest at base, narrowing to eyes; eyes finely facetted, prominent; vertex strongly produced, produced part narrow at base and widening to seat of antennæ. Two pairs of dorsal cephalic bristles. Antennæ very long and slender. Prothorax without the long recurved prolongations seen in *Mecynothrips*, and fore-femora unarmed. Tube long.

Type *Dracothrips ceylonicus*, sp. n.

Dracothrips ceylonicus, sp. n.

♂ (?).—Length a little over 7·0 mm.

Head broad at base, narrowing to about 0·7 that width at behind eyes; produced part not 1·5 times as long as eye, narrow at base. Antennæ very slender, about 1·4 times as long as head, joints 3–5 yellow, black at apices, 6 yellow at base; relative lengths of joints 3–5 approximately:—65 : 55 : 40. A pair of dorsal bristles in addition to the postocular pair, and three pairs of rather long genal setæ.

* It should be noted that *Dicaiothrips denticollis*, Bagnall, a Malayan form, possesses this additional pair of dorsal cephalic bristles.

Prothorax with the bristles at angles set on warts, the front pair set directly forward. Fore-femur not strongly incrassate, with a few long colourless and faintly knobbed bristles. Fore-tibiæ yellowish-red; intermediate tibiæ shaded to yellow distally and hind-tibiæ yellow at knee and distal half.

Abdomen long and slender; tube 0·9 the length of head; bristles on segment 9 about 0·6 the length of tube.

I have not yet had the opportunity of re-examining the type of *Mecynothrips simplex*, Bagn. (in the British Museum), which I think will fall into this genus. *M. simplex* has the fore-femora strongly inflated, shining, sparingly setose, and armed with a short tooth at apex within, and the tube is shorter in comparison with the length of head.

Type. In Hope Collections, University Museum, Oxford.

Hab. CEYLON: Peradeniya, two examples, almost certainly males, swept from bushes (*E. E. Green*, No. 2961). They were in association with *Ecacanthothrips sanguineus*, Bagn.

Family **Megathripidæ.**

Siphonothrips brevis, sp. n.

♂.—*Forma aptera.*

Length 2·1, breadth of mesothorax about 0·38 mm.

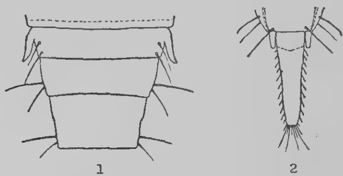
General colour dark black-brown, abdomen darker than the head and prothorax. All femora brown, the intermediate and posterior pairs light yellowish-white basally, and lighter at extreme base; all tibiæ yellow, tarsi also yellow with a dark patch on second joint. Antennæ with first two joints dark brown; second lighter apically; 3 yellow, lightly tinged with brown near apex; 4 yellow, apical fourth brown; 5 brown, with basal half yellow (6 to 8 broken off in type-specimen, 7 and 8 at least presumably totally brown).

Head 1·8 times as long as broad across eyes, 2·8 times as long as the prothorax, but only very slightly (0·08) longer than the tube. Cheeks very slightly incurved behind eyes and thence gently arcuate to base; a few minute genal spines. Vertex slightly produced beyond eyes, with a pair of rather long bristles, which do not reach to apex of first antennal joint. Eyes small, occupying laterally 0·2 the length of the head, finely facetted; ocelli minute. Mouth-cone reaching across prosternum, rounded at tip. Antennæ about twice as long as the head (first 5 joints = 1·5 times

the length of head); relative lengths of joints 1 to 5:—
7 : 10 : 30 : 24 : 21.

Prothorax transverse, twice as broad as long; all setæ present, slightly knobbed, those at hind angles longest, almost 0·5 as long as the prothorax. Pterothorax a little broader than long, wings absent. First pair of legs rather short and somewhat stout; simple. Intermediate also short and somewhat stout; hind pair longer and more slender, femur 1·5 times the length of intermediate femur, broadest at distal third; tibia correspondingly long.

Side of abdomen gently arched to sixth segment, which is armed with a pair of short and comparatively stout, outwardly curved lateral processes and reaching slightly beyond the apex of segment; 7 evenly narrowing apically; 8 about as broad across apex as across base, with a pair of mid-lateral tubercles faintly suggested.



Siphonothrips brevis, sp. n., ♂.
1. Abdominal segments 6 to 8. 2. Tube.

Tube broadest at basal fourth, thence sharply narrowed, and continued to basal fifth or thereabouts, with the sides practically parallel, basal fifth sharply narrowed; viewed laterally the tube is sharply curved upwards at or about the basal third, so that the distal two-thirds is on a higher level than the base. Surface sparsely furnished with moderately short and very delicate hairs. Terminal bristles weak, only about one-third the length of the tube, light-coloured. Abdominal bristles also weak, those on 7 and 8 directed outwardly.

Type. In Hope Collections, University Museum, Oxford.
Hab. One male, coll. Prof. J. Sahlberg, Narenta.

Family **Phlœothripidæ.**

Liothrips micrurus, sp. n.

♀.—Uniformly dark brown, including fore-tibiæ, as in *L. major*, Buffa. Antennæ with second joint yellowish distally and 3–5 lemon-yellow, 4 and 5 deepening to

brownish-yellow distally, 6–8 light brown, 6 yellowish distally. Wings clear.

Head a little more than 1·5 times as long as broad; cheeks not converging posteriorly; vertex raised in form of hump. Antennæ 1·5 times as long as head, inserted below vertex, approximate, joint 3 not as broad as 2 and 4; relative lengths:—16 : 18 : 31 : 31 : 24 : 23 : 17 : 9. Eyes occupying one-third the length of head; fore-ocellus on apex of raised vertex, directed forwards. Postocular bristles set well in towards mid-line, very short and weak. Mouth-cone long and pointed, reaching to base of prosternum.

Prothorax with anterior margin strongly emarginate, more than twice as broad across hind-angles as long through middle, but only 1·5 times as broad as long, taking the length from posterior margin to a line drawn across anterior angles. Mid-lateral setæ absent, others short, the postero-marginal ones about 0·4 the length of prothorax through middle, and those on anterior margins about 0·2 as long. Pterothorax 1·5 times as broad as the prothorax and a little longer than broad.

Abdomen no broader than pterothorax, gradually narrowing to segment 7 and thence a little more rapidly to tube. Tube very short, not one-half (0·47) the length of head and only 1·38 times as long as segment 9. Sides straight, evenly narrowed from base, where it is about 2·25 times as broad as at apex and more than 0·6 as broad as long. Bristles at tip and on segment 9 about 0·8 the length of tube, weak and colourless; two pairs of wing-retaining spines on each of the tergites 2 to 7.

Separated from *elongatus*, Bagn. (Neotropical), which has also a very short tube, by the coloration of the antennæ.

Type. In Hope Collections, University Museum, Oxford.

Hab. One ♀, Matarieh, near Cairo, from *Zyziphus*, 9.ix.1911 (*F. C. Willcocks*).

The type-specimen is cleared in potash, so that it is possible to get but an approximate idea of the coloration; the colour of the antennæ is taken from a second example captured by Prof. Sahlberg at Heluan. This example, carded, showed a pronounced metallic purplish coloration, but I do not think it was natural.

Cryptothrips tenuipilosus, sp. n.

♀.—Length 2·4 mm., breadth of mesothorax 0·52.

Colour chestnut to dark grey-brown, apical half of tube

lighter than base; fore-tibiæ yellow with inner and outer margins brown, fore-tarsi yellow. Antennæ brown, joint 3 yellow lightly tinged with brown distally; 4 light brown with basal third and tip yellow; 5 to 8 dark brown, 5 and 6 with basal fifth or thereabouts sharply yellow.

Head 1·23 times as long as broad just behind eyes, and 1·4 times as long as the prothorax; cheeks straight; evidently slightly diverging posteriorly, sparsely and minutely setose. Eyes finely facetted, occupying nearly 0·3 the length of head; space between them about three times the breadth of one of them. Ocelli large, posterior pair above a line drawn across middle of eyes and near their inner margins; anterior one forwardly directed. Postocular bristles long and very slender. Antennæ about 1 8 times as long as the head, relative lengths of joints 3 to 8 as follows:— 24 : 25 : 24 : 19 : 18 : 14 — 3 and 4 equally broad and 5 about 0·2 narrower than either of them. Sense-cones short and stout, 2 (or more) on 3, 4 on 4, and 2 each on 5 and 6. Mouth-cone almost reaching across prosternum; basal joint of maxillary palpi longer than the distal joint.

Prothorax almost twice as broad as long; setæ very slender, those at anterior angles 0·4 and those at posterior angles 0·7 as long as the prothorax. Pterothorax large, 1·35 times as broad as prothorax and but slightly longer than broad. Fore and intermediate legs rather short, hind pair moderately long. Fore-femora slightly incrassate, tarsus unarmed. Wings reaching to about eighth abdominal segment, apparently slightly narrowed medianly; cilia dark.

Abdomen a little broader than pterothorax, gradually narrowing from segment 3 to 7, and thence more roundly and rapidly to base of tube. Tube 0·65 as long as the head, terminal hairs very slender, colourless distally, and about as long as the tube. Those on 9 exceptionally slender and also about as long as the tube; lateral bristles on 4–8 long, slender, colourless.

Type. In Hope Collections, University Museum, Oxford.

Hab. Corfu, 1 ♀ collected by Prof. J. Sahlberg, to whom I am indebted for a small but interesting collection, including the types of *Siphonothrips brevis* and the species here described.

Recognized by its short head, structure and coloration of antennæ, coloration of legs, and the unusually slender postocular, prothoracic, and terminal abdominal bristles.

Cryptothrips insularis, sp. n.

Length about 2·25, breadth of mesothorax 0·38 mm.

Near *C. dentipes*, Reut. Colour almost black; legs dark brown, tibiæ somewhat lighter apically; tarsi yellowish-brown. Antennæ concolorous with head, joint 3 yellow, dark brown near apex.

Form linear, apterous.

Head as in *dentipes*, about 1·25 times as long as broad behind eyes and about twice as long as the prothorax. Eyes small, occupying 0·25 the length of head, moderately finely facetted. Ocelli small, posterior pair widely separated and touching inner margins of eyes. Antennæ 1·75 times the length of head, intermediate joints not elongated as in *dentipes*, 3–5 approximately subequal and but slightly longer than 6.

Prothorax transverse, about 1·8 times as broad as long; two foveæ, one above the other, near each lateral margin. Pterothorax only a little broader than the width across fore-coxæ, transverse. Legs somewhat short.

Abdomen elongated, linear, a little broader than the pterothorax; segments 8–9 sharply narrowing to base of tube. Tube short, stout, 0·6 the length of head. Setæ indeterminable in the carded specimen.

Type. In the British Museum of Natural History.

Hab. Canary Isles (*T. V. Wollaston*).

The shape of the head is almost exactly as in *C. dentipes*, but not quite so broad. From this species it is readily separated by its linear form, the short antennæ (twice as long as the head in *dentipes*) and short intermediate joints, the darker fore-tibiæ, shorter legs, and the short tube, which in *dentipes* is as long as the head.

Genus MICROCANTHOTHRIPS, nov.

For some time I have been aware that my *Cephalothrips spinosus* could not be retained in that genus. A very strong artificial light enables one to examine the femora tucked up under the head through the dark chitin, and I have thus drawn up the following brief diagnosis, which is sufficient to characterise the genus for the time being. If further specimens do not come to hand, I propose to carefully remount the unique preparation.

It cannot be referred to any of the known genera with armed fore-femora, and would seem to come in the *Haplothrips* group.

Head only slightly longer than broad; eyes small; mouth-cone rounded and reaching almost across prosternum. Antennæ not quite twice as long as head, unusually massive; joint 7 constricted at base with a short stem, joined broadly to 8; 3 longer than any of the others. Fore-femur with a

Fig. 3.

3

Microcanthothrips spinosus (Bagnall). Outline of fore-femur.

long sharp process at middle within; tibia stout; tarsal tooth small. Abdominal segments 4–7 at least with a stout spine-like seta (in addition to a long stout bristle) at each posterior angle and a short but similar postero-marginal spine within.

Type. *Cephalothrips spinosus*, Bagn.

Synonymical Notes.

Limothrips angulicornis, Jablonowski.

1894. *Limothrips angulicornis*, Jablonowski, Természetrajzi Füzetek. xvii., Budapest, pp. 44–47, pl. iii.
1912. *Limothrips setariæ*, Jones, Tech. Ser. 23, Bur. Ent., U.S. Dept. Agric. pp. 8–10, pl. iii.

When Mr. Jones described his *L. setariæ* I thought it would probably be the same as the species described by Dr. Jablonowski eighteen years previously from Armenia and Hungary, but it seems to be a rare species and I had not then seen examples. I have now before me several females and one male of a *Limothrips* collected by Dr. Anton Krausse, at Sorgono, Sardinia, in 1913, which agree in every detail with Jones's description and figures, though darker in colour, and which I have little doubt are referable to *Limothrips angulicornis*. Dr. Jablonowski does not figure the stout terminal spines, nor does his figure of the chætotaxy of the fore-wing agree, but we see exactly similar discrepancies in his figures of *Limothrips cerealium* (*op. cit.* xvii. 1894, pts. 3 & 4, pl. iv.) appearing in a later part of the same publication.

Dendrothrips ornatus (Jablonowski).

1894. *Thrips ornata*, Jablonowski, Termesz. Füzetek. xvii., Budapest, pp. 93–99, pl. iv.
1895. *Dendrothrips tiliæ*, Uzel, Monogr. der Ordnung Thysanoptera, pp. 160–162, pl. ii. fig. 15, and pl. vi. figs. 84–86.

Jablonowski's memoir was evidently issued whilst Uzel's work was in the press, and is not noticed in the latter author's bibliographical notes.

Baliothrips dispar, Haliday.

1911. *Bagnallia agnessæ*, Bagnall, Journ. Econ. Biol. vi. p. 7, and in later papers.

The maxillary palpus of *agnessæ* is undoubtedly 2-segmented, thus bringing the species into the genus *Baliothrips*, and I think there is no doubt that it should be referred to *B. dispar*, though my examples are much larger than described by Uzel. Having overlooked its generic position, this accounts for my previous inability to recognize this not uncommon species, *B. dispar*, in Britain.

I am indebted to Mr. Douglas Hood, who detected the synonymy in working out the North-American species, for bringing this to my notice.

Genus SCOLOTHRIPS, Hinds.

1902. *Scolothrips*, Hinds, Proc. U.S. National Mus. xxvi. p. 157.
1910. *Chætothrips*, Schille, Acad. Litt. Cracov. xlv. p. 5 (*separatim*).

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 8. Vol. xiv., *November* 1914.

Brief Descriptions of new Thysanoptera.—IV. By RICHARD S. BAGNALL, F.L.S., F.E.S. (Hope Department of Zoology, University Museum, Oxford).

Suborder TEREBRANTIA.

Family Æolothripidæ.

Æolothrips gloriosus, sp. n.

♀.—Length about 1·1 mm.

General colour lemon-yellow. Abdominal segments 9 and 10 and tergite 8 entirely black; tergites 5 to 7 each with a blackish-brown bar almost covering the tergite, and signs of brownish markings on the anterior halves of other tergites. Eyes black. Head shaded with light greyish-brown, excepting the vertex and posterior corners, and pronotum with an indistinct marking down mid-line, expanding anteriorly and posteriorly and in centre of disc. Mesonotum and triangular disc of metanotum greyish-brown. Fore-wings lightly tinged with brown at base and with an irregular brown bar across second and fourth fifths; cilia brown. Antennal joints 1, 2, and basal half or thereabouts of 3 light lemon-yellow; rest black, the apical joints somewhat greyish black. Tips of tarsi with brown fleck.

Head rather long, quadrate, and not quite as long as the pronotum; basal joint of maxillary palpus much larger than the two apical joints together; mouth-cone large and long. Antennæ about 2·5 times as long as the head; joint 2 rather long; 3 pedicellate, cylindrical, and narrower than 2, 4, or 5; 4 distinctly angularly produced distally; 5 to 9 closely united, with 5 as long as 6 to 9 together. 3 1·5 times as

long as 2, scarcely longer than 4; 5 to 9 together about 1·3 times the length of 6; elongate sense-areas on 3 and 4, the latter running into the produced part. Posterior ocelli almost touching margins of eyes.

Pronotum quadrate, without any long bristles, but with a basal-marginal series of minute black setæ.

Wings reaching to abdominal segment 6, typical of the genus; setæ minute, cross-veins distinct.

Abdomen with minute setæ, excepting the long bristles on 9 and 10, and a moderately conspicuous lateral pair on 8. Sutures of sternites 3–4, 4–5, 5–6, and 6–7 showing a dark transverse line; underside and sides otherwise (excepting apex) yellow.

Hab. Sorgono, Sardinia; 3 ♀s amongst a tube of Thysanoptera collected by Dr. A. H. Krausse, and kindly submitted to me by Dr. W. Horn of the German Entomological Museum.

Suborder Tubulifera.

Family **Hystricothripidæ**.

Genus Holurothrips, nov.

Head broad, length to a line across anterior margins of eyes only a little longer than broad, but vertex narrowly produced beyond eyes for 0·75 the length of the head to base of produced part. Series of 4 stout knobbed spines at about middle of produced part. Posterior ocelli between eyes near anterior margins, anterior one near apex of produced vertex. Antennæ, excepting basal joint, very long and slender; longer than tube.

Abdomen broad, depressed, much as in *Hystricothrips*, Karny. Tube long and slender, about three times the length of *total* length of head and two-thirds the length of abdominal segments 1 to 9.

Differs from allied genera by the striking form of head and the extremely long slender antennæ.

Type. *Holurothrips ornatus*, m.

Holurothrips ornatus, sp. n.

Total length 4·6 mm.; length of tube 1·4 mm.

General colour dark blackish-brown; prothorax and distal part of mesothorax, anterior corners and margins of abdominal segment 2, and lateral margins of 3–7 yellowish-red,

the lateral margins of 8 reddish-brown. Tube yellowish, greyish near base and shading to blackish-brown at distal third. Legs yellow, shaded lightly with brown in parts.

Surface of head striate or subreticulate; cheeks each with one seta near middle, and a shorter knobbed one on a small wart just behind eye. Eyes moderately finely facetted; stout knobbed bristle protecting each posterior ocellus. Basal antennal joint stout, brown; 2 smaller, light yellow—both with minute knobbed setæ; 3–8 yellowish, stems shaded with greyish-brown in parts. Relative lengths of joints approximately 5 : 4 : 37 : 21 : 18 : 11 : 7 : 7.

Pronotum strongly transverse, about 0·4 times as long as broad; setæ on warts, knobbed, a stout pair at anterior angles forwardly directed, those on posterior angles not quite so stout and mid-lateral pair smaller.

Pterothorax transverse, broadest near juncture with the abdomen. Legs much as in *Hystricothrips.* Wings slender, nearly reaching to the seventh abdominal segment.

Abdomen broadest near base and thence narrowing to base of tube, segment 8 only 0·35 as broad as 2. Tube very long and slender, sparsely and finely setose. Terminal hairs broken in the specimens at disposal. Lateral abdominal setæ rather short, stout, knobbed, and colourless; one at each posterior angle directed at right angles from the body.

Hab. Matang, Sarawak, at 1000 ft.; two examples in decaying leaves, 2. xii. 1913 (*G. E. Bryant*).

Leeuwenia indicus, sp. n.

Very near *Leeuwenia gladiatrix,* Karny, a little smaller and broader, with a more slender tube, which is about 1·2 times the length of the abdominal segments 1–9 together.

Uniform dark chestnut-brown, surface roughly reticulated. Antennal joint 2 lighter distally and 3–8 yellow, extreme tip brownish.

Antennæ a little longer than head and prothorax together; joints 3–6 clavate, 3 and 4 practically subequal; 5 shorter than 4; 6 shorter than 5; 7 and 8 broadly united, pointed apically and together about as long as 5.

Abdomen broader than in *gladiatrix*, with the dorsal and wing-retaining spines very poorly developed. Tube not so curved as in *gladiatrix* and only sparsely and somewhat minutely setose, with setæ more or less recumbent, the most distal third or fourth being almost destitute.

Separated from *gladiatrix* by its thin and more finely

setose tube, which in that species is coarsely setose, with both long and short, stout, suberect setæ almost to the apex; also by the dark uniform coloration of the body and the poorly developed wing-retaining and dorsal abdominal spines.

The abdomen (excluding tube) is longer and not so stout in *gladiatrix*, and the tube therefore only about 0·6 the length of the segments 1–9 together. The surface of *indicus* is apparently more strongly reticulated and sculptured than in *gladiatrix*.

Hab. One specimen from the Indian Museum (no. $\frac{4297}{20}$), Moulmein, Lower Burma, 16. xi. 11 (*F. H. Gravely*).

Family **Idolothripidæ.**

Acanthinothrips annulipes, sp. n.

Length 8 to 9 mm.

Colour black, shining. Antennal joint 3 greyish-yellow, dark at extreme apex, with yellowish patch just before it; stem of 4 greyish-black. Distal half of fore-tibiæ yellow, with black ring just before apex, the intermediate tibiæ similar, but with ring near apex broader and not so sharply defined basally; hind-femora with a yellowish-white ring (in one specimen reddish) at about middle. All tarsi yellowish, dark apically. Wings grey—mid-ribs and cilia dark brown.

Head about 2·7 times as long as broad near base, cheeks slightly narrowed between eyes and base, and furnished with a few slender setæ. Vertex slightly produced beyond eyes. Posterior ocelli on a line drawn through anterior third of eyes, the anterior one near apex of produced part. Antennæ extraordinarily slender (excepting the two basal joints), about 3·7 times the length of the head; relative lengths of joints approximately 7 : 6 : 71 : 42 : 33 : 24 : 11 : 9. Postocular bristles close together and set rather far back. Eyes finely facetted.

Pronotum about 0·42 the length of head; setæ weak and colourless.

All femora thickened distally and furnished with several stout and rather long yellow bristles, somewhat as in *Anactinothrips*. Wings reaching to the sixth abdominal segment.

Abdomen long, segments somewhat as in *Actinothrips longicornis*, apical angles of the hindmost segments, at least, each with a short, stout, yellowish-brown spine, and the ninth with an additional pair on each side of the mid-line.

Tube about twice as long as the head, surface coriaceous;

sparsely setose; terminal hairs short, yellowish. Abdominal hairs moderately short, weak, and colourless.

A very distinct species.

Hab. Matang, Sarawak; 1 on dead bark, 1000 ft., 13. xii. 13; 2 on the wing, 2000 ft., 24. xii. 13; 1 Sungei China, Fort of Matang, Sarawak, by beating dead leaves, 14. xii. 13 (*G. E. Bryant*).

Anactinothrips distinguendus, sp. n.

♂.—Length 7·5 mm.

Colour chestnut-brown, tube darker near base and yellowish distally. Antennæ with second joint yellowish distally, 3 with stem yellowish, lightly shaded with brown about middle and apex brown; 4 with stem yellowish, shaded near middle, and 5 lighter basally. Wings greyish-yellow, cilia tinged with brown.

Head twice as long as prothorax and twice as long as broad near base, shaped as in *A. meinerti*, Bagn., but shorter and broader. The pair of dorsal bristles set at about the basal third, only one-half the length of the postocular bristles, weak; anteocular pair short, pointed, reaching to beyond the middle of the first antennal joint. Eyes finely facetted, occupying laterally about 0·22 the total length of the head. Ocelli moderately large, equidistant, the posterior pair close to inner margins of eyes and on a line through their middle.

Antennæ almost as in *A. meinerti*, but with the fifth joint about four-fifths the length of the fourth (instead of one-half the length in *A. meinerti*); approximate lengths of joints:— 14 : 12 : 84 : 50 : 40 : 22 : 15 : 12. Sense-cones very short and slender, scarcely distinguishable.

Prothorax as in *A. meinerti*, the postero-marginal bristles broken off in the single preparation, but presumably long; pair at anterior angles short and curved, and the mid-lateral pair long and strong, about 0·65 the median length of pronotum. Maxillary palpi with the second joint three times as long as the basal.

Pterothorax 0·4 broader than the prothorax, transverse. Wings and legs much as in *A. meinerti*.

Abdomen evenly narrowing to tube, with each of the segments 3 to 7 slightly and roundly produced into a prominence for the seating of bristles, which latter are evidently (from the few that are preserved) not particularly long or strong.

Tube about 0·8 the length of the head, a little more than

twice the length of the ninth segment, not three times as long as broad at base, and twice as broad at base as at apex.

Hab. British Guiana, Bartica; 1 ♂ collected by Mr. G. E. Bodkin, with *Dicaiothrips brevicornis*, Bagn., and *D. lævicollis*, Bagn., from the leaves of the mangoe-tree, June 15th, 1913.

The unique example is, unfortunately, imperfect, and has been cleared in caustic potash and mounted in balsam. It is only the second described species of *Anactinothrips*, and is readily separated from *A. meinerti*, Bagn., by the short and relatively broad head and tube, the relative lengths of the antennal joints, and the short dorsal cephalic bristles as compared to the postocular pair. The second joint of the maxillary palpi is only *twice* the length of the basal in *A. meinerti*.

Phoxothrips breviceps, sp. n.

♀.—Length 2·7 mm. Form linear.

Dark chestnut-brown, head and abdomen almost black. Fore-tibiæ and all tarsi yellow. Third antennal joint yellow, shaded brown basally and distally; basal half of 4 and base of 5 yellow. Head only 2·25 times as long as broad at widest, namely at about the posterior fifth, where it is as wide as across eyes. Produced vertex with sides parallel; 0·25 the total length of head. Eyes laterally occupying about 0·23 the total length of head.

Antennæ at least 1·25 times the length of the head; relative lengths of joints:—3 : 5 : 11 : 9 : 7 : 6 : 4 : 4—3 to 5 clavate as in *P. pugilator*.

Prothorax about 0·35 the length of head, and 1·4 times as broad as long; broadest through middle, where it is 1·25 times as broad as the head. A somewhat slender seta at each hind angle.

Pterothorax 1·25 times as wide as the prothorax, longer than broad. Legs somewhat long, especially the hind pair; fore-femora not incrassate (or armed) in the ♀, and tarsus without tooth. Wings reaching to segment 7.

Abdomen not broader than the pterothorax, narrowing from segment 7 to base of tube. Tube about 0·6 the length of head, and twice as broad at base as at apex; terminal hairs not quite as long as the tube. Abdominal hairs slender and colourless, those on ninth segment longer than tube.

Easily separated from *P. pugilator*, Karny, by its much

smaller size, the relatively short head, the longer second antennal joint, &c.

Hab. Simla, W. Himalayas, at 7000 ft., 7. v. 1910. Coll. Dr. N. Annandale. One specimen in the Indian Museum, 4300/20.

From the Annals and Magazine of Natural History,
Ser. 8, Vol. xv., *March* 1915.

Brief Descriptions of new Thysanoptera.—V.

By Richard S. Bagnall, F.L.S., F.E.S.

Suborder Terebrantia.

Family Æolothripidæ.

Subfamily *Melanothripinæ.*

Melanothrips fuscus (Sulzer).

Tunis: Tunis, 56 ♀♀ and 2 ♂♂, Feb. 7th, and 1 ♀, Feb. 20th, 1903; Sousa, 2 ♀♀ and 1 ♂, Feb. 28th, 1903 (*Biro*). In the National Hungarian Museum.

Genus Cranothrips, nov.

Apex of the first antennal segment strongly produced inwardly, with the inner edge of the produced part serrate.

Fig. 1.

Cranothrips poultoni. First and second joints of right antenna.

Head broader than long; a long stout genal spine behind each eye and inter-ocellar and postocular bristles present.

Fore-wings with cross-veins.

Type. *Cranothrips poultoni*, m.

The genus comes very near *Ankothrips*, and is easily recognized by the structure of the first antennal joint and the simple second joint.

Cranothrips poultoni, sp. n.

♀.—Length 1·65, breadth of mesothorax 0·25 mm.

Colour grey-brown; fore-legs yellow-brown; antennæ with the produced part of first joint clear yellow, joint 3 yellow tinged with grey, and 4 yellowish-brown. Fore-wings light grey-brown, with the first and third fourths white.

Head broader than long, broadest near base. Eyes large, somewhat coarsely facetted, pilose, occupying at least 0·5 the length of the head. A long stout genal spine behind each eye; inter-ocellar and postocular spines rather long. Mouth-cone reaching across prosternum; maxillary palpi long, apical joint shorter and narrower than either joints 1 or 2. Antennæ more than twice as long as head, first joint with the characteristic prolongation described in the generic diagnosis, which almost reaches the apex of the second joint. Relative lengths of joints 3–9 as follows:—19 : 17 : 16 : 15 : 9 : 6 : 8.

Prothorax about as long as the head and 1·75 times as broad as long; furnished with several stout setæ, of which the mid-lateral pair, two at each hind angle, and certain of the postero-marginal series are the longest.

Legs typical of the family; femora and tibiæ sparingly setose. Pterothorax large, 1·25 times longer than broad, sides rounded, giving an oviform appearance.

Wings broad, reaching to the seventh abdominal segment. Fore-wings broadest near middle, where they are nearly 0·2 (one-fifth) as broad as long; both longitudinal veins set with, roughly, 20–22 longish black spines, and costa with about 36. Cilia on lower edge wavy.

Abdomen elongate-ovate, tenth segment shorter than ninth, setæ on 9 and 10 about as long as segment 9.

Hab. Western Australia, near Fremantle, on flowers (nos. 17 and 22). The only named flower is a proteaceous shrub (*Dryandra floribunda*, R. Br.), and it is impossible to say whether this species is attached to *Dryandra* (or any other flower) or is a general species.

I find particular pleasure in naming the species after Prof. E. B. Poulton, F.R.S., who obtained several other interesting species on the occasion of the recent British Association visit to Australia, and who has encouraged my researches in many directions.

Subfamily *ÆOLOTHRIPINÆ*.

Æolothrips fasciatus (L.).

TUNIS: numerous specimens collected by Mr. Biro in 1903, as follows:—Tunis, 5 ♀♀ and 1 ♂, Feb. 7th, and 4 ♀♀, Feb. 26th; Sousse, 1 ♂ and 1 ♀, March 28th; Gafsa, 26 ♀♀ and 5 ♂♂, March 24th, and Gafsa Oasis, 1 ♀, March 25th. National Hungarian Museum.

CANARY ISLANDS: Las Palmas, Grand Canary, 1 ♀ on *Sisymbrium officinale*, June 28, 1914 (*Prof. E. B. Poulton*).

Æolothrips brevicornis, sp. n.

♀.—Length 1·25 mm.

Reddish- to chestnut-brown; fore-legs and third antennal joint yellowish-brown.

This species comes in the "*fasciatus*" group with banded wings, and differs from all the species excepting *fasciatus* in having the abdomen unicolorous. Apart from its small size, *brevicornis* may be separated from *fasciatus* by its shorter antennæ, which are approximately 2·2 times (instead of about 3 times, in *fasciatus*) the length of the head. The intermediate antennal joints are relatively shorter compared with their breadth; joints 3 and 4 are practically subequal, whereas in *fasciatus* joint 3 is 1·2 times the length of 4. In the species of the "*fasciatus*" group in which the base of the abdomen is banded with white the last four (6 to 9) antennal joints are together much longer than the fifth; in *fasciatus* they are practically equal to the fifth (20 : 19), whilst in *brevicornis* they are much shorter than the fifth (19 : 14).

Hab. SOUTH AFRICA: Cape Town, 1 ♀ shaken from a flower, July 13th, 1914 (*Prof. E. B. Poulton*).

Family **Thripidæ**.

Heliothrips femoralis, Reut.

GERMAN EAST AFRICA: Arusha, 1 ♀ in the collection made by Mr. C. Katona in October and November 1905. National Hungarian Museum.

The species is generally regarded as a hothouse one, but I also have an example taken with *H. hæmorrhoidalis* on banana-palm, Spain.

Heliothrips brunneipennis, sp. n.

Length about 1·5 mm., linear.

Colour dark brown; head yellowish-brown and abdomen apically lighter. Fore-femora and tibia yellow, lightly tinged with brown; intermediate and hind femora and tibiæ dark brown, basally yellow, the tibiæ also yellowish-white distally; all tarsi whitish-yellow. Fore-wings brown, darkest at base, a light patch in about the third tenth; hind wings light greyish-brown, with median vein darker; cilia dark. Antennæ with basal joint yellowish; 2 brown, 3 to 5 clear lemon-yellow, 6 brown, and style yellowish-white.

Head more than 1·8 times as broad at broadest (near base) as long. Cheeks swollen behind eyes, subparallel to a collar-like thickening before constriction at base, which runs in an arc close to the hind margin of the eyes; reticulations behind collar larger, but not so strong. Eyes large, coarsely facetted, and weakly setose. Ocelli large, posterior pair on a line through middle of eyes. Maxillary palpi 2-segmented. Antennæ at least twice as long as the head, lengths of joints 3 to 8 relatively 26 : 26 : 18 : 10 : 3 : 10,—3 and 4 spindle-shaped, 5 claviform, and 6 globular; style bristle-like. Forked trichomes on 3 and 4 curved, exceptionally long and slender, one of the arms on 4 being 1·7 times the length of that joint.

Prothorax broader than long, posterior margin from about centre of lateral margins arcuate. Pterothorax large and broad, and about as long as broad. Wings reaching to middle of abdominal segment 8. Fore-wing about 15 times as long as broad through middle, not upcurved distally. Setæ rather short and slender, dark; costa with 25/26, increasing in length towards apex of wing; upper vein with 4 near fork and 2 near apex, and lower vein with 1 + 2 + 1 + 1 + 1, the last situated towards the end of the fourth fifth—that is, before the first of the two distal bristles of the upper vein.

Abdomen elongate-ovate, occupying about 0·6 the total length of insect, not broader than the pterothorax. Segments 8 to 10 evenly narrowed to tip; 9 about 1·8 times as long as 10; bristles on 8–10 moderately long, pale.

Hab. Ceylon, Peradeniya, feeding on the leaves of *Litsea chinensis* (*A. Rutherford*, no. 3648, Ent. Research Comm. no. 60).

Dinurothrips rutherfordi, sp. n.

♀.—Length about 1·1 mm.

Dorsal surface deeply reticulated.

Yellow, shaded with reddish- to chestnut-brown, deepest towards sides of head, thorax, and abdomen. Fore-tibiæ yellow, femora brownish; intermediate femora and tibiæ brown, yellowish distally; hind-femora greyish-brown, tibiæ yellow. Antennæ much as in *D. hookeri*, Hood, yellow, second joint deeper in shade, greyish-brown apically. Fore-wings greyish, yellow in line of veins, with an indistinct brownish band near base and across the seventh eighth, and other scarcely defined bands; setæ stout, dark brown basally to yellow (in some) at points; hind-wing with brown median vein.

Head about twice as wide across eyes as long, longer than the prothorax. Cheeks roundly narrowed posteriorly and constricted abruptly at base; explanate, the shelf-like margins projecting somewhat distally in the curve of the outer posterior margin of the eye. Eyes prominent, occupying about 0·5 the length of the head, coarsely facetted and not pilose; space between them almost twice the width of the eye. Ocelli and antennæ almost as in *D. hookeri*. Vertex also with shelf-like margin. Maxillary palpi apparently 2-jointed.

Prothorax with broad, wing-like, explanate, lateral margins, anteriorly wider and more broadly rounded than posteriorly. Pronotum proper transverse, not as broad as the head, with a series of lateral and antero-marginal setæ in pairs, and a pair of pre-basal ones, one on each side of the median line.

Pterothorax massive, twice as broad as the pronotum proper (*i. e.* excluding the explanate margins); metanotum narrower than the mesonotum, the latter sharply narrowed to juncture with abdomen, which is waist-like. Wings reaching to abdominal segment 8, slender and linear; fore-wings not upwardly curved distally, veins running close to margins; setæ on costa stout and widely spaced, only 8 or 9; those on veins both longer and stouter; upper vein with 2 near base, 1+1 in second fourth and 1+1+1 in distal third; lower vein with 8 setæ, 2 near base and then 1+1+3+1. Top fringe somewhat sparse, lower long and wavy.

Abdomen elongate, slightly broader than the pterothorax; surface of each segment anteriorly and laterally deeply reticulated; ninth partially received into eighth; tenth

cylindrical, divided dorsally, about 0·7 the length of head and 0·5 the length of segment 9. Bristles on 9 only about 0·7 the length of 10; a stoutish bristle on each side of the longitudinal division of segment 10 near apex, 0·8 the length of the segment.

Larvæ yellow; head, pronotal plates, and last two abdominal segments dark greyish-brown; legs dirty greyish-yellow to brown.

Type. British Museum of Natural History.

Hab. Ceylon, Peradeniya, on leaves of *Allamanda*, 20. 2. 14, *A. Rutherford* (A. R. no. 3673, Ent. Res. Comm. no. 61), also 27. 3. 14 (no. 83).

This species differs from the type of the genus, *D. hookeri*, Hood, in the explanate lateral margins of head, the broader and complete wing-like lateral explanations of prothorax, the series of pronotal setæ, and the abnormally strong spines of the fore-wing, which in *hookeri* are few and inconspicuous. The forms and lengths of abdominal segments 9 and 10 in the two species also differ markedly.

Genus Rhipiphorothrips, Morgan.

Rhipiphorothrips, Morgan, Proc. U.S. Museum, vol. xlvi. p. 17 (August 23, 1913).
Retithrips, Bagnall (nec Marchal), Ann. & Mag. Nat. Hist. ser. 8, vol. xii. (Sept. 1, 1913).

A comparison between *Rhipiphorothrips pulchellus*, Morgan, from Banyan, Philippine Islands, and my *R. bicolor* from Vine, Ceylon, described within a few days of each other, will be interesting. If not one and the same species, they are at least very closely related.

Suborder Tubulifera.

Family **Ecacanthothripidæ.**

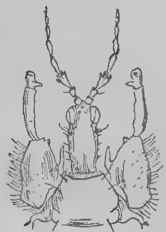
Ecacanthothrips bryanti, sp. n.

♂.—Very like *sanguineus* and *steinskyi*, all tibiæ and tarsi yellow in one specimen, in another hind and intermediate tibiæ brownish. Coloration of antennæ as in *sanguineus*. Postocular bristles present, and also a somewhat similar subgenal bristle behind each eye. Fore-femur with basal tooth long and strong, reddish distally; sparingly setose, the outer margin with a fringe of several longer and shorter hairs.

Antennæ with joints 4–8 longish and slender; 3 brownish, 4 and 5 brownish, yellowish near base.

Setæ at fore-angles of prothorax long and strong. Abdominal setæ long and strong, colourless; those on segment 9 longer than the tube. Tube little more than 0·5 the length of the head.

Fig. 2.



Ecacanthothrips bryanti, sp. n. Head, antennæ, prothorax, and fore-legs.

Easily recognized by the long hairs on the fore-femora. Also separated from *steinskyi* by the coloration of the antennæ.

Hab. 2 ♂s, Mt. Matang, W. Sarawak, one from dead tree 17. xii. 13 and the other 17. i. 14. Collected by Mr. G. E. Bryant, to whom I am indebted for some very interesting material, and after whom I find pleasure in naming the species.

Ecacanthothrips sanguineus (Bagnall).

CEYLON, on and under the bark of trees. Respectively met with by both Mr. Green and Mr. Rutherford.

Ecacanthothrips steinskyi (Schmutz), 1913.

Ormothrips steinskyi, Schmutz.

CEYLON, Peradeniya, ♂ and ♀, from bark of tree, 25. v. 13 (*A. Rutherford*).

Ormothrips inermis, Buffa.

BORNEO, 1 ♂, Mt. Matang, W. Sarawak, xii./13 (*G. E. Bryant*).

Family **Phlœothripidæ.**

Docessissophothrips laticeps, sp. n.

♂.—Length 3·0 mm.

Apterous.

Colour dark reddish-brown; fore-tibiæ and all tarsi yellowish.

Head much as in *D. ampliceps*, Bagn., smooth and shining, about 1·25 times as long as broad, and viewed laterally only weakly arched compared with *ampliceps* and other species of the genus. Eyes small and finely facetted, occupying about 0·2 length of head; ocelli small and widely spaced, a long bristle behind each posterior ocellus; two pairs of long post-ocular bristles, the outer pair being the longer. Genal spinelets few.

Antennæ black, about twice the length of head, joints 2–4 yellowish, 3 grey-brown at apex, and 4 shading to brown apically; 3–5 clavate.

Prothorax strongly transverse, about 2·5 as broad as long and 0·4 the length of head, all setæ long, at least those on hind margin as long as the prothorax. Pterothorax transverse. Legs long, fore-femora not very stout, with long setæ at outer edge near middle, all tibiæ with long setæ near knee, fore-tarsus with tooth. Abdomen broad, with segments strongly transverse, laterally with reddish patches as far as segment 7; 8 rounded sharply to 9, 9 only slightly narrowed. Tube long and stout basally, 1·22 times the length of head, narrowed to distal half, with a weak constriction before apex; surface smooth, but with a scale-like sculpturing, almost aciculate; apical hairs rather short, dark, only about 0·35 the length of the tube, those on 9 about 0·7 as long as the tube, those on 6 and 7 longer than on 9, and on 8 shorter.

Of the described species, *D. ampliceps*, Bagn. (Central America), *D. monstrosus*, Bagn. (New Caledonia), *D. major*, Bagn. (no data), and *D. frontalis*, Bagn. (Japan), this species can only be compared with *ampliceps*, and is separated by its broader and (viewed laterally) less strongly arched head, the three pairs of long cephalic bristles, the longer setæ on fore-margin of prothorax, etc. It is the least extreme species of the genus, whilst *monstrosus* is the most extreme. Only a single example is known of each of these striking species, which would seem to suggest extreme rarity or, perhaps, specialized habitat; the fact that Mr. Bryant found the

specimen under review with termites would seem to strengthen the latter suggestion.

Hab. 1 ♂, Mt. Matang, W. Sarawak, 28. i. 14, under bark with termites (*G. E. Bryant*).

Hindsiania apicalis, sp. n.

♀.—Length 1·7 mm.

Colour yellow to light yellowish-brown; abdominal segments 8 to 10 dark chestnut-brown; head, intermediate and hind tibiæ brown. Antennal joints 1, 2, 7, and 8 brown, 2 sometimes yellowish distally, 3 to 5 clear yellow, 6 tinged with brown. Fore-femora and tibiæ yellow, tinged to greyish-brown at outer margins; intermediate and hind femora yellow.

Head only about 1·15 times as long as broad; cheeks practically subparallel, almost imperceptibly curved. Mouth-cone not reaching across prosternum, apex almost truncate. Eyes occupying about 0·3 the total length of head; post-ocular bristles neither strong or long, blunt. Ocelli moderately large, posterior pair near to the interior margins of eyes. Antennæ about 1·8 times as long as head; relative lengths of segments approximately 6 : 11 : 12 : 14 : 13 : 11 : 11 : 8; 3 obconical, 4 broader than 3 or 5, 7 and 8 broadly united.

Pronotum transverse, about 0·75 the length of head; setæ blunt, those at posterior angles about 0·2 the length of pronotum and pair at angles still shorter and weaker; mid-lateral pair apparently obsolete. Pterothorax practically square, as broad as width across fore-coxæ. Legs not long, moderately stout; fore-tarsus with a small pointed tooth.

Abdomen occupying about 0·65 the total length of insect, broader at middle than the pterothorax; elongate, about four times as long as broad across segments 3 to 6, and narrowed sharply from base of 8 to apex.

Tube about 0·55 the length of head, 0·65 as broad at base as long, where it is 2·4 times as broad as at extreme apex; sharply narrowed and rather constricted near apex. Terminal hairs a little longer than tube; abdominal hairs moderately long and slender, blunt or faintly knobbed, colourless.

The coloration of the hind and intermediate tibiæ is a curious feature, the femora and tarsi being yellow and the tibiæ brown.

Hab. India, Almora, Kumaon, 5500 ft., several swept from jungle plant, 4. vii. 11 (*O. Paiva*, no. 4295/20).

Liothrips micrurus, Bagnall.

Ann. & Mag. Nat. Hist. ser. 8, vol. xiii. p. 292 (March 1914).

This species is apparently attached to *Zyziphus spini-christi*, and was described from a specimen obtained by Mr. F. C. Willcocks at Matarieh, near Cairo. Mr. Willcocks has found other specimens on the same tree from Ezbet-el-Nakhl, February, and at Gizeh, near Cairo, March 1911. Evidently rare.

In describing it I stated that a carded specimen captured by Prof. Sahlberg of Helsingfors at Heluan exhibited a pronounced metallic-purplish coloration.

Mr. Willcocks has furnished me with the following live-colour notes of the species—the first known thrips to exhibit metallic coloration of any kind :—

Head, thorax, and abdomen deep metallic violet—in some lights appears jet-black; hairs on abdomen pale. Eyes very dark brown. Antennæ: two basal joints dark, others pale yellowish-brown. Wings silvery, with pale brownish fringe. Legs deep metallic violet.

Genus ALEURODOTHRIPS, Franklin, 1909.

Chromatothrips, Schmutz (type *C. fasciata*, Schmutz), K. Akad. Wiss. Wien., Mathem.-Naturw. Kl. cxxii., July 1913, p. 1043.

I consider that the type-species of *Chromatothrips* is closely related to *Aleurodothrips fasciatipennis*, Franklin, and congeneric with it.

Aleurodothrips fasciapennis (Franklin).

Ceylon, Peradeniya, 1 ♂ taken by Mr. A. Rutherford among *Aspidiotus lataniæ*, 27. vi. 1913.

The only difference I can detect in this example and specimens from Florida lies in the coloration of the antennæ, the former having the sixth joint entirely grey-brown. *A. fasciatus* closely resembles this species, but is easily distinguished by the coloration of the body, antennæ, and legs.

Androthrips flavipes, Schmutz.

Androthrips flavipes, Schmutz, *l. c.* cxxii. p. 1031 (July 1913); Bagnall, Ann. & Mag. Nat. Hist. ser. 8, vol. xiii. p. 27 (Jan. 1914).

From the Annals and Magazine of Natural History, Ser. 8, Vol. xv., *June* 1915.

Brief Descriptions of new Thysanoptera.—VI.
By Richard S. Bagnall, F.L.S.

Suborder Terebrantia.

Family **Thripidæ**.

Genus Homothrips, nov.

Head transverse, cheeks diverging posteriorly. Antennæ of usual Thripid type, but having a 3-jointed style which is not quite so long as the sixth joint. Mouth-cone constricted near middle, reaching across prosternum; maxillary palpi long, 3-jointed, the middle joint the shortest. A pair of very long fine inter-ocellar bristles, and four immediately behind antennæ between eyes. Prothorax transverse, with two long bristles at each hind angle. Fore-legs simple. Wings well-developed; fore-wings with both veins regularly set with setæ. Abdomen elongate; last two segments normal, and bristles on them long.

Type. *Homothrips distinctus*, mihi.

This genus differs from all genera excepting *Rhampothrips*,

Karny, in the 3-jointed antennal style. From the latter it may at once be separated by the simple fore-tibiæ and tarsi and the regularly set upper-vein of fore-wing.

Homothrips distinctus, sp. n.

♀.—Length 1·4 mm.

General colour yellow; legs, basal antennal joints, and abdomen lighter, almost white; tip of abdomen and disc (at least) of tergites 2–8 slightly tinged with brown; mesothorax near juncture with prothorax, the disc of pronotum and the head (excepting a patch at hind corners, from the eye broadening posteriorly) brown. Antennæ approximate, joints 3–5 weakly claviform, 6 constricted at base and broadly united to style; relative length of joints 3 to 9 approximately 15 : 14 : 11 : 13 : 3 : 3 : 5. Forked trichomes on 3 and 4. Eyes very largely facetted, and minutely and sparsely pilose. Ocelli set well back.

Prothorax about as long as head and about 1·6 times as broad as long, surface sparsely setose. Bristles at posterior angles about 0·75 the length of the prothorax. Pterothorax longer than broad and broader than the prothorax. Legs usual, rather stout; hind-tibiæ with a double row of setæ inside for the distal two-thirds of its length. Wings reaching to abdominal segment 8; setæ of fore-wing long; costa, upper vein, and lower vein furnished with 25, 22 (5 and 17), and 15 respectively; lower cilia long. Abdomen long and linear; segment 9 sharply narrowed to base of 10, and bristles on these segments strong and considerably longer than the segment bearing them; 9 furnished with a latero-dorsal pair in addition to the series at apex.

Hab. South Africa, from flowers of "sugar-bush" (Proteaciæ), gathered at Cape Town, July 13th, 1914 (*Professor E. B. Poulton*).

A. Physothrips group.

Genus Megalurothrips, nov.

Allied to *Physothrips.* Head with a long and strong pair of inter-ocellar bristles, maxillary palps . . . . . . Bristles on prothorax . . . . . . Mesonotum with a long bristle somewhat remote from each shoulder. Both veins of fore-wing regularly set with setæ. Abdominal segments 9 and 10 abnormally large, together longer than the length of head and prothorax, sharply obconical.

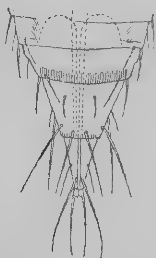
Megalurothrips typicus, mihi.

Megalurothrips typicus, sp. n.

♀.—Length about 1·4 mm.

General colour dark brown; fore-tibiæ yellowish distally, and all tarsi yellowish. Antennal joints 3 and 4 yellow, the latter shaded brown distally, and 5–8 light brown, with 5 yellowish at base. Fore-wings light yellowish-brown, with a light patch near base and another near tip. Head transverse, 1·4 times as wide as long; eyes coarsely facetted, pilose. A series of minute dorsal setæ on a line behind eyes.

Fig. 1.



Megalurothrips typicus, gen. et sp. n. End of abdomen, ♀. Dotted line showing ovipositor and sheath.

Ocelli rather large, the hind pair well separated and the posterior one forwardly directed and protected by a pair of very long inter-ocellar bristles which are as long as the two basal antennal joints together. Antennæ about 2·6 times the length of the head, joint 3 *apparently* shorter than 4; 5 distinctly shorter than 3, 4, or 6; the style about 0·5 the length of 6, with the apical joint longer than 7. Trichomes and bristles long.

Prothorax 1·4 times as long as the head. It is impossible to say from the imperfect specimen if there is one or two long bristles at each hind angle. Legs rather stout. Pterothorax about as long as broad, large. Wings reaching to the ninth abdominal segment; costa, upper and lower veins of fore-wings furnished with approximately 22, 17 (3 + 14), and 15 longish setæ respectively. Abdomen (excluding segments 9 and 10) elongate-ovate, 9 and 10 subequal in length and distinctly longer than any of the preceding segments and sharply obconical; 10 open above.

A pair of straight lateral bristles on 8 reaching beyond the middle of 9, and 9 and 10 furnished with long bristles, longer than the segments bearing them, and those on 9 over-reaching the tip of 10.

Hab. W. SARAWAK, Mt. Matang; 1 ♀ caught on the wing, December 1913 (*G. E. Bryant*).

Tæniothrips seticollis, sp. n.

♀.—Length 1·3 mm.

Dark grey-brown, thorax yellowish in part, head darker than the prothorax. Antennæ with joint 1 yellowish-brown, 2 lighter, 3 yellow, 4 to 8 greyish-brown, with 4 lighter basally. All femora yellowish to grey-brown; tibiæ yellow, lightly shaded to grey or grey-brown; tarsi yellowish. Fore-wings light greyish-brown, basal fourth white.

Head nearly as long as broad, cheeks swollen and eyes prominent; surface transversely striate. Eyes coarsely facetted, pilose. Ocelli on a prominence, large, posterior pair placed close to inner margin of eyes and well back, anterior one forwardly directed.

Antennæ at least twice as long as head; joints 3 and 4 fusiform, practically subequal; 5 about 0·85 the length of 4, and 6 practically as long as 4, the two-jointed style very short, only 0·3 the length of joint 6. Forked trichomes on 3 and 4.

Prothorax slightly longer than the head and about 0·8 as long as broad; the two long bristles at each hind angle slender and more than 0·5 the length of prothorax. Surface and side sparingly set with somewhat longish setæ, mostly curved and directed backwards. Fore-legs stouter than the others and (with hind and intermediate legs) also set with rather long curved setæ; the hind-tibiæ furnished for the length of the inner margin with a double row of straight setæ, terminating distally with a pair of stout yellow spines. Pterothorax more than twice as long as the pronotum and as broad across mesonotum as long. Wings long, reaching to the eighth abdominal segment. Fore-wings pointed distally; upper vein furnished with 19 and lower vein with 17 moderately long setæ. Setæ on costa 27, increasing in length towards apex of wing; upper fringe sparse, delicate; lower fringe wavy. Abdomen elongate-ovate, broader than the pterothorax and approximately 2·5 times as long as broad; segments 8 and 9 sharply narrowed to base of 10; 10 open above. Abdominal bristles light brown, those on 9 and 10 longer than the segments bearing them.

Hab. W. Australia; 1 ♀ taken by Professor E. B. Poulton, F.R.S., with examples of *Isoneurothrips australis*, sp. n., from the flowers of a small tree of *Acacia* sp. (probably *A. baileyana*, F. v. Müll.), Mundaring Weir, Darling Range, Perth, August 3rd, 1914 (tube 16).

Differs from known species by the fore-vein of fore-wing, which is regularly set with setæ—a character generally regarded as of generic importance.

B. Thrips group.

Genus Isoneurothrips, nov.

With all the characters of *Thrips* (+*Bagnallia*), but having the whole of the upper-vein of fore-wing regularly set with setæ as well as the lower.

Type. *Isoneurothrips australis*, mihi.

a. *Thrips* s. str. type.

Isoneurothrips australis, sp. n.

♀.—Length 1·4 mm.

General colour yellow, with dark setæ. Head only lightly tinged with grey, vertex brownish; pronotum yellowish-brown; pterothorax tawny, tinged with brown at margin. Abdomen yellow, segments 9–10 wholly dark grey-brown, other tergites light grey-brown and pleurites yellowish. Legs yellow, tinged with grey. Fore-wings greyish-yellow with setæ and cilia dark. Eyes black and ocelli with crimson hypodermal crescentic margins. Head transverse, about 0·7 as long as broad; cheeks arcuate. Eyes prominent, coarsely facetted, pilose. Some short, erect, genal setæ behind eyes and a dorsal series approximately on a line behind eyes.

Antennæ about three times as long as the head; first joint yellow, second grey-brown, third yellowish, irregularly tinged with grey-brown; fourth and fifth rich purple-grey, yellow basally, and 6 of the same rich colour in the basal two-thirds, but with the apical third together with the style light grey. Joints 3 and 4 fusiform, and together with 6 approximately subequal; 5 much smaller and style very short.

Prothorax longer than head, bordered anteriorly; the two prothoracic bristles at each hind angle about one-third the length of the pronotum, stout and almost black; a series of shorter postero-marginal setæ. Surface sparsely and minutely

setose. Legs almost as in the previously described species, but with more minute setæ, and the series of setæ on inner side of hind tibiæ shorter and stouter and starting at about the middle. Pterothorax large, at least 1·6 times as broad as the prothorax and but slightly longer than broad; disc faintly reticulated. Wings reaching to eighth abdominal segment; setæ of fore-wing short, stout, and very dark. Costa, upper and lower vein furnished with approximately 38, 28 (3+7+18), and 23 setæ respectively, upper fringes sparse, lower wavy. Abdomen elongate, narrower than the pterothorax, with sides subparallel to segment 6, thence faintly narrowing to 8; 9 and 10 together obconical, and the latter open dorsally; bristles on 9 and 10 long.

A fine, richly coloured species.

Hab. W. AUSTRALIA; taken by Professor E. B. Poulton from the flowers of a small *Acacia*-tree (probably *A. baileyana*, F. v. Müll.). Mundaring Weir, Darling Range, Perth, Aug. 3rd, 1914 (tube 16), and from the flowers of *Acacia pulchella*, R. Br., Cottesloe Beach, near Fremantle, Aug. 31st, 1914 (tube 26).

b. *Bagnallia* type.

Isoneurothrips orientalis, sp. n.

♀.—Length approximately 1·4 mm.

Colour dark blackish-brown; fore-femora lighter brown, with tibiæ yellowish, shaded to brown at margins; intermediate tibiæ somewhat lighter distally. Antennal joint 3 yellowish-white, tinged with grey to a light brown, 4 greyish-white at base and 5 to 7 entirely brown. Head about 0·85 as long as broad, surface transversely striate; eyes moderately largely facetted, pilose. Ocelli large, placed well back, and posterior pair touching the inner margin of eyes. Antennæ 2·2 times as long as the head, joints 4 to 7 slender, 3 and 4 constricted near apex; approximate length and breadth of 3 to 7 as follows:—

$$\frac{18 : 19 : 14 : 18 : 5}{6 : 7 : 5 : 5 : 2}.$$

Prothorax quadrate, scarcely longer than the head; 1·5 times as broad as long. Setæ at hind angles long, 0·5 as long as the pronotum. Legs much as in *I. australis*. Wings grey-brown, setæ longer and more slender than in *I. australis*. Abdomen long and linear.

♂.—Smaller. Sternites 3 to 7 each with a strongly transverse area much as in *Baliothrips dispar*, the first two being the largest.

Hab. W. Sarawak, Mt. Matang, at 1000 feet, December 20th, 1913; 2 ♀s and 1 ♂ in a white flower (*G. E. Bryant*).

Unfortunately imperfect.

Suborder Tubulifera.

Family **Phlœothripidæ.**

A. Macrothrips group.

Adiaphorothrips antennatus, sp. n.

Length about 5·0 mm.

Very like *A. simplex*, Bagn.; head shorter and less than 1·5 times as long as broad, genal setæ and the inter-ocellar bristles distinctly longer and stronger than in *simplex*. Antennal joints 3 to 5 practically subequal, 3 being apparently shorter than 4 (approximately 21 : 23 : 22, instead of 29 : 26 : 21 in *simplex*). Male smaller, with the head comparatively longer, and the tube only about 1·15 times the length of the head as compared with 1·3 times the length in the female. A distinct wart at extreme apex of each fore-tibia within.

Hab. W. Sarawak; 1 ♀, Mt. Matang, at 1000 feet, from under bark of dead tree, Dec. 7, 1913, and 1 ♂, Quop, March 28th, 1914 (*G. E. Bryant*). Mr. Bryant also collected examples of *A. simplex* from both localities.

B. Trichothrips group.

Genus Tetracanthothrips, nov.

Comes in *Trichothrips* group. Size small. Head broader than long, cheeks arcuate, narrowed to base, and armed with short strong spines. Mouth-cone . . . . Antennæ . . . .

Prothoracic setæ very long. Fore-coxæ with one long strong seta and a few shorter ones. Anterior margin of mesonotum armed on each side with two stout finger-like spines and other smaller ones. Tube normal in shape, but with distinct though somewhat weak longitudinal carinations basally.

The spine-like mesonotal processes are a peculiar feature.

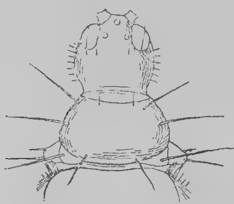
Type. *Tetracanthothrips borneensis*, m.

Tetracanthothrips borneensis, sp. n.

♂.—Length about 1·6 mm.

Dark brownish-black, shining; pterothorax medianly in form of an inverted triangle light yellowish-brown; head not so dark as prothorax; the two basal antennal joints (rest broken off in the unique specimen) yellow. Fore-legs yellow to yellowish-brown, with the femora shaded to brown basally; hind and intermediate legs darker, but yellowish above knees. Tube brownish at apex. Fore-legs incrassate; intermediate and hind-femora with some strong spines on the upper margin near or beyond middle. Bristle at each hind angle of prothorax longer than the length of the prothorax through middle. Wings short, vestigial. Abdomen broadly ovate; segments strongly transverse. Tube not quite so

Fig. 2.



Tetracanthrothrips borneensis, gen. et sp. n. Head, pronotum, fore-coxæ and front of mesonotum.

long as the head. Abdominal hairs long; those on segment 9 as long as tube, and on 6 and 7 longer; mostly dark, but some on 8 and 9 practically colourless.

Hab. W. SARAWAK; 1 brachypterous ♂, Mt. Matang, December 1913 (*G. E. Bryant*).

Allothrips caudatus, sp. n.

♂.—Forma *macroptera.*

Length about 2·3 mm.; breadth of pterothorax 0·45 mm.

Yellowish- to greyish-brown; head and pterothorax yellowish medianly. Abdomen dark grey to black-brown; tube reddish, shaded with brown at apex. Fore-legs yellowish, shaded to grey-brown; outer margin of femora darkest; hind and intermediate femora dark grey-brown; all tarsi yellow. Antennal joint 3 yellow, tinged with grey distally; 4 and 5 yellowish, shaded with grey-brown basally and distally; 6 yellowish basally. Head large, as broad as long and nearly

twice the length of the prothorax; cheeks very slightly converging posteriorly. Eyes occupying dorsally about one-third the length of head, finely facetted; postocular bristles long, pointed. Ocelli large, placed well forward, the posterior one situated at the apex of raised vertex and forwardly directed. Mouth-cone short, broadly rounded, and reaching about 0·65 way across the prosternum; labial palps rather long. Antennæ about twice the length of the head, seven-jointed, joints 3 to 5 claviform and 3 and 4 practically subequal. Relative lengths and breadths of joints 3 to 5 :—

$$\frac{30 : 32 : 28 : 24 : 28}{13 : 14 : 12 : 11 : 10}.$$

Joint 6 constricted apically and truncate distally, and 7 elongate, oviform. Sense-cones long and slender.

Prothorax strongly transverse, more than 2·5 times as broad as long; all prothoracic setæ present, long and pointed, the postero-marginal pairs about 0·6 the length of prothorax. Fore-legs incrassate, tarsal tooth stout; single prominent seta on each coxa. Pterothorax scarcely broader than the breadth across fore-coxæ, about 0·875 as long as broad. Wings reaching to abdominal segment 8; cilia smoky brown. Abdomen slightly broader than pterothorax, elongate, with segments strongly transverse; segments 7 to 9 roundly narrowed to base of tube. Tube a little longer than the head, twice as broad at base as at apex; more sharply (and somewhat roundly narrowed) from about middle. Terminal hairs only about 0·4 the length of tube. Abdominal bristles yellowish, pointed, some on 7 to 9 long, the longest on 9 being about 0·8 the length of the tube.

Sharply separated from the only other described species, *A. megacephalus*, Hood, by its coloration, larger size, the longer antennal joints 3 to 7, the shorter pronotum and mouth-cone, the long tube, and nature of chætotaxy.

Hab. W. Sarawak; 1 ♂, Mt. Matang, Dec. 11th, 1913 (*G. E. Bryant*).

Family **Ecacanthothripidæ.**

There are evidently several species of *Ecacanthothrips*, and all available material requires re-examination. *E. bryanti*, Bagn., *E. crassiceps*, Karny, *E. sanguineus* (Bagn.), and *E. steinskyi* (Schmutz), have already been described; but in Mr. Bryant's very interesting Bornean material is a series of *Ecacanthothrips* characterized by the simple fore-coxæ of the male. There appears to be three species—a small one, a

medium-sized one with all tibiæ clear yellow, and a black one. I now describe the first two.

Ecacanthothrips coxalis, sp. n.

Length, ♂ 1·75, ♀ 2·1 mm.

This species (and the following one) has the fore-coxæ in the ♂ simple, and in the shape of the fore-femora and teeth comes nearest to *E. steinskyi* (Schmutz), but is only very minutely pilose. Colour dark reddish-brown, including the hind and intermediate tibiæ; fore-tibiæ greyish-yellow, with outer and inner margins brownish. Antennæ just about 2·0 the length of head, with joints 1 black, 2 to 4 entirely chestnut-brown, 5 to 8 lighter grey-brown with basal halves of 5 and 6 yellow, 4 broadly claviform, 5 much narrower and 3 to 5 subequal in length.

Head inclined to be broadly subcarinate dorsally, 1·65 times as long as broad; at least two stout genal spines on each side, postocular bristles not as long as the eyes, and a pair of knobbed subgenal setæ as in *bryanti* but much shorter.

Tube short, very stout; approximately 0·45 the length of the head.

Hab. W. SARAWAK, neighbourhood of Mt. Matang; 2 ♀s (1 to light), December 1913, and 1 ♂, February 1914 (*G. E. Bryant*).

Ecacanthothrips flavipes, sp. n.

♂.—Length about 2·6 mm.

Very dark brown, almost black, shining; all tibiæ and tarsi clear yellow. Antennal joints 4 and 5 yellow, shaded to brown basally and distally; joints 4 and 6–8 more slender than in *coxalis*; 4 and 5 subequal and each apparently longer than 3.

Head much as in *coxalis*, with the cheek-spines stouter; postocular bristles longer and the subgenal setæ distinctly shorter than in that species. Tube stout, about 0·6 the length of the head.

Easily separated from *coxalis* by its larger size, distinctive coloration of legs and antennæ, longer tube, and the stouter fifth and more slender fourth antennal joints. The setæ on fore-femora are not quite so minute, and the lower tooth is sharper and not so stout.

Hab. W. SARAWAK, Mt. Matang, at 1000 feet; one on a white flower and three on dead bark, December 1913 (*G. E. Bryant*).

From the ANNALS AND MAGAZINE OF NATURAL HISTORY, Ser. 8, Vol. xvii., *March* 1916.

Brief Descriptions of new Thysanoptera.—VII.

By RICHARD S. BAGNALL, F.L.S.

Suborder TEREBRANTIA.

Family **Thripidæ**.

Heliothrips frontalis, sp. n.

H. hæmorrhoidalis group.

♀.—Length about 1·15 mm.

Head, prothorax, pterothorax, and apex of abdomen golden-brown, shaded to brown laterally; frons brown; legs yellow, femora slightly deeper in coloration than the tibiæ, especially the intermediate pair. Body, excepting apex, chestnut-brown, with a sublateral pair of black rings or "eye-spots" on tergites 3 to 7. Antennæ broken in the unique specimen except the first two joints, which are light yellow. Fore-wing clouded with yellowish-brown at base and with the veins in the third sixth (or more) and the fifth sixth dark brown; veins otherwise except at extreme apex (distal sixth), where they are colourless, yellowish to light yellowish-brown.

Head subquadrate, strongly reticulated, about 0·8 as long as broad across eyes; cheeks very slightly arched behind eyes, and then as faintly sinuate or convergent posteriorly. Eyes small, only occupying about one-third the length of the head, and the space between them at least 2·5 times the width of one of them. Antennæ . . . . Vertex produced

into an exceptionally prominent hump, with anterior ocellus facing forwards at summit and the posterior pair evidently flanking the sides.

Prothorax only about 0·7 the length of the head, transverse, with angles rounded; widest near posterior angles, where it is twice as wide as long; surface with network reticulation as in head, except a belt across disc. Pterothorax widest at junction of meso- and metathorax. Legs much as in allies, hind-tibiæ long, slender basally. Wings reaching to sixth abdominal segment, fore-wings slightly upturned distally, with veins (including marginal) strong; upper vein fused with costa; lower vein joining the hind-margin at or just before the distal sixth. Costal fringe of about fifteen curved setæ; lower cilia also sparse, fumate, rather long, slender, and wavy.

Abdomen comparatively heavy, elongate-ovate, and about 1·4 times as broad as the pterothorax at broadest. Tenth abdominal segment long, more than twice as long as broad near base, divided above. Apical setæ vestigial, a pair on 9, at hind angles, only about 0·3 the length of segment 10.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. AUSTRALIA, Healesville, Victoria; on *Senecio duyardeus*, 1 ♀ only (*R. Kelly*).

Genus AUSTRALOTHRIPS, nov.

Strong network reticulation. Antennæ 8-segmented, style normal, not setiform; joint 2 quadrate, cup-shaped, hollow at apex for reception of 3. Head transverse, hind-angles prominent; eyes prominent; maxillary and labial palpi 3- (?) and 2-jointed respectively.

Prothorax without any prominent setæ, transverse, with lateral, explanate, wing-like margins. Wings straight, not reticulated; fore-wing with strong ring-vein, upper vein merged in costa, and lower vein appearing as a median vein; no cilia or setæ on costa, no setæ on veins, and lower margin with cilia fine. Hind-wing with strong median vein; a series of slender setæ or cilia on upper margin and a long slightly wavy fringe on lower margin.

Tenth abdominal segment short, broad, cylindrical.

Pterothorax and abdomen much as in *Rhipiphorothrips*.

Type. *Australothrips bicolor*, mihi.

Differs from *Dinurothrips*, the only other genus with

explanate lateral margins of the prothorax, in the simple antennal style and the structure of fore-wings, which are without setæ and cilia on the costa.

Australothrips bicolor, sp. n.

♀.—Length about 1·1 mm.

Orange-yellow; head, prothorax, mesothorax, scutular area, and sides of metathorax dark chestnut-brown; fore and intermediate femora dark brown; hind-femora and fore and intermediate tibiæ lightly tinged with brown. Antennæ with joint 6 apically and style brown; first joint lightly tinged with brown. Scale of fore-wing, small patch adjoining, and mid-vein and cilia of hind-wing brown.

Head about 1·8 times as broad as long, cheeks slightly converging, and hind angles prominent; network reticulation of surface strong, especially below an arcuate raised line behind eyes. Eyes prominent, space between them about twice the width of an eye. Vertex sinuate on each side of raised part, having the antennæ, which are twice as long as the head, seated in the sinuations. First antennal joint short; second quadrate, with distal cup-shaped hollow for reception of 3; 3 long, claviform, constricted at apex; 4 and 5 cylindrical, with minute stem, and 4 also narrowly constricted at apex; 6 broadest basally; 7 and 8 together styliform, and the relative lengths and breadths as follows:—

$$\frac{16:34:48:28:24:22:8:13}{20:30:16:17:17:14:7:\ 5}.$$

Prothorax as long as or only slightly longer than the head, and (excluding the lateral explanate margins) as broad as the head. Legs comparatively short and stout.

Posterior margins of abdominal tergites with more or less regularly placed, minute, blunt projections; setæ on segment 9 short and those on 10 very short, colourless.

♂.—Smaller, more slender. Lemon-yellow where orange-yellow in ♀. Tergite 8 set with four long and rather stout spines set on an arcuate series of tubercles.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. AUSTRALIA, Healesville, Victoria; on *Eucalyptus viminalis* (R. Kelly).

Tæniothrips major, sp. n.

♀.—Length about 2·0 mm.

Colour dark chestnut-brown; fore-tibiæ, hind-tibiæ basally, all tarsi, and third antennal joint not quite so dark. Fore-wings brown, slightly lighter distally.

General form as in *T. inconsequens* (Uz.).

Head almost as long as broad; eyes bulging, coarsely facetted, pilose; cheeks swelling out from behind eyes as in *T. primulæ* and *inconsequens.* A series of dorsal and lateral setæ on a line behind eyes. Ocelli large; a pair of very long and strong inter-ocellar bristles situated between the posterior ocelli; a shorter pair on vertex close to inner margins of eyes and beyond the anterior ocellus, which is directed forwards. Dorsal surface transversely striate in basal half or thereabouts. Antennæ long and slender, about 2·3 times the length of head; joints 3 and 4 fusiform; relative lengths of joints:—16 : 22 : 40 (with stem) : 36 : 25 : 32 : 4 : 5; forked trichomes on 3 and 4 long and slender.

Prothorax transverse, not quite as long as the head; broadest at posterior angles; bristles at posterior angles long and slender; a line demarcating posterior margin; a pair of longish mid-dorso-lateral setæ, and several short setæ, curved and chiefly lateral. Pterothorax large. Wings long, strong, pointed at apex, reaching to ninth abdominal segment; setæ slender. Fore-wings with three or four setæ on distal half of upper vein, namely, one just within the distal half and 1+0+1 or 1+1+1 in the distal fifth or thereabouts.

Abdomen elongate, pointed at apex from base of segment 8; apical bristles long, especially those on 9, which is also furnished with a pair of shorter dorsal bristles.

This is a true *Tæniothrips,* coming nearest *inconsequens* (*pyri*), from which it differs chiefly in the much larger size and darker coloration, the chætotaxy, and in the slender antennæ.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. INDIA, Kulhara, Garhwal, 11,700 feet altitude; in flowers of rhododendron, 5. vi. 10, together with *Physothrips longiceps*, sp. n. (*A. D. Imms*).

Tæniothrips inconsequens, Uzel.

1895. *Physopus inconsequens*, Uzel (and others).
1904. *Euthrips pyri*, Daniels (and others).

For some time I have considered that the well-known

pear-thrips, *P. pyri*, was synonymous with the earlier-described *P. inconsequens* of Uzel, a conclusion that Mr. C. B. Williams had also come to. On going into the question together recently, comparing material from North America, Central Europe, and England, we confirmed this opinion.

It is interesting to note that in the Czech account of the habitat of *P. inconsequens* in Uzel's monograph the food-plant *Prunus cerasus* is mentioned.

For a pest of such importance the trivial name *inconsequens* is unfortunate.

Odontothrips fasciatipennis, sp. n.

♀.—Length 1·3 mm.

Dark brown, pterothorax rather lighter; fore-tibiæ light yellow, shaded to grey-brown basally; apices of intermediate and hind tibiæ and all tarsi light yellow; antennal joints 3 and 4 yellow.

Fore-wing with basal third clear, then a band or patch of brown, and the distal two-fifths with but the slightest tinge of grey; cilia grey-brown. Posterior ocelli on a line drawn behind eyes and contiguous to their inner angles. Fore-tibial teeth small, sharp, the larger sharply bent; fore-tarsus apparently without tooth.

This species differs from both *phaleratus* (Hal.) and *intermedius* (Uz.) in the coloration of the wings.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. S. AUSTRALIA, Outer Harbour, Adelaide; collected by Prof. Poulton in the flowers of *Mesonbryanthemum*, Aug. 28th, 1914.

Genus PHYSOTHRIPS.

a. *Sjostedti-usitatus* group.

Physothrips usitatus, Bagn., var. *cinctipennis*, nov.

Fore-wings with the middle third and extreme tip greyish-brown. Relative lengths of antennal joints as follows:—
12 : 16 : 25 : 25 : 16 : 23 : 7 : 8.

Distinguished from the type-form (only known from India) by the distinct clear band near distal end of fore-wing. This band is weakly suggested in the Indian specimens.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. N. QUEENSLAND, Brandon; on small flowers (pea), 16. x. 14 (*R. Kelly*).

Physothrips brunneicornis, sp. n.

♀.—Length 1·4 to 1·5 mm.

Colour brown, the antennæ, head, prothorax, intermediate and hind femora and tibiæ, and apical abdominal segments inclined to be darker. Antennæ unicolorous, fore-tibiæ yellow, shaded with greyish brown along margins; all tarsi yellow. Fore-wings faintly clouded with light grey-brown near base; basal third or thereabouts clear, thence smoky-brown to tip excepting for an ill-defined clear patch at about the commencement of the distal fifth; setæ and cilia dark.

Head about 0·7 as long as broad and not quite as long as the prothorax; a defined area of the dorsal surface behind transversely striated. Eyes coarsely facetted, minutely pilose; cheeks not arched, tending to widen posteriorly; ocelli large, posterior pair above a line drawn across hind margins of eyes; interocellar bristles long and strong, placed between the anterior ocellus and the posterior pair. Antennæ seated below vertex, about 2·5 times as long as the head; relative lengths of joints 3 to 8 as follows:—22 : 22 : 14 : 20 : 5 : 6. Joints 5 and 6 somewhat broadly united and distinctly more slender than the preceding; forked trichomes on 3 and 4 long and stout.

Prothorax much as in *P. usitatus*.

Fore-wing and arrangement of setæ as in *P. usitatus*.

Abdomen about 1·15 times as broad as the pterothorax, segments 9 and 10 obconical; apical bristles long and stout; 9 with a rather short dorsal pair widely separated.

This species very closely approaches *P. usitatus*, Bagn., but is at once separated from it (as well as from *sjostedti*, Trybom, and *variabilis*, Bagn.) by the unicolorous antennæ. The antennal joints 3 and 4 would appear to be stouter and 6 shorter than in *usitatus*, whilst the fore-femora are concolorous with the prothorax.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. JAPAN, Kobe, April 1914 (*J. E. A. Lewis*). Reg. no. 144.

Physothrips seticollis (Bagnall).

Tæniothrips seticollis, Bagnall, 1915, Ann. & Mag. Nat. Hist. ser. 8, xv. p. 591.

This species cannot be referred to the genus *Tæniothrips* as exemplified by *inconsequens*, *primulæ*, and *major*, sp. n.

b. *Funtumiæ* group.

Physothrips kellyanus, sp. n.

♀.—Length 1·6 to 1·8 mm.

Very like *P. funtumiæ*, Bagn.

Dark chestnut-brown, antennæ with the distal constricted parts of joints 3 and 4 colourless; fore-tibiæ and all tarsi yellow. Fore-wings yellowish-brown, basally lighter; hind-wings also fumate, with ciliæ and median vein dark.

Head a little broader than long, eyes setose; interocellar setæ long. Relative lengths of antennal joints 3 to 8 as follows:—27 : 27 : 17 : 26 : 4 : 6.

Prothorax as long as or very slightly longer than head; setæ at hind angles long, but not stout, and one rather long pair in the postero-marginal series. Setæ on fore-wing long, upper vein with two in distal half near extreme end and 3 + 3 near base.

Apical abdominal bristles long.

♂.—Length about 1·2 mm., slender.

Each of the sternites 3 to 7 with numerous minute, roundish, irregular, pale depressions, those at angles, especially the anterior, slightly larger. Tergite 9 with a series of short spines in a line near posterior margin.

Colour of antennæ as in ♀; joint 6 abnormally long; relative lengths of joints 3 to 8 as follows:—26 : 25 : 13 : 36 : 3 : 4·5.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. N. Queensland, Brandon, ♂ and ♀ on a composite flower (? *Helianthus* sp.), 16. x. 14; Brisbane, numerous ♀♀ and 1 ♂ on *Acokeanthera spectabilis* (a South-African plant), in the Botanic Gardens, 23. x. 14.

Victoria, Ballarat, 1 ♂ on *Hypochæris radicata*, 18. i. 15.

One of the many interesting species discovered by Mr. Reg. Kelly, after whom I find pleasure in naming it.

The ♂ is easily separated from ♂ *Ph. funtumiæ* by the nature of the depressions in sternites 3 to 7, the line of spines in ninth tergite, the unicolorous antennæ, and the exceptionally long sixth joint.

c. *Pallipennis* group.

Physothrips brevicornis, sp. n.

♀.—Length 1·2 to 1·3 mm.

Colour dark brown, fore-tibiæ, apices of fore-femora and of hind and intermediate tibiæ and all tarsi yellowish; fore-wings wholly greyish yellow-brown, hind-wings greyish at base. Antennæ with first joint and style grey to grey-brown, second dark brown, 3 to 5 yellowish, the latter very lightly tinted with grey; 6 yellow, with distal half grey-brown.

Head transverse, about 0·65 as long as broad, cheeks apparently converging posteriorly; eyes large, not bulging, coarsely facetted and very minutely setose; interocellar bristles moderately long. Antennæ short and rather stout, a little more than twice as long as the head; relative lengths and breadths of joints 3 to 8 as follows:—

$$\frac{32 : 29 : 26 : 36 : 6 : 11}{18 : 18 : 14 : 15 : 6 : 4},$$

3 to 4 broadly claviform.

Prothorax transverse, about 1·25 times longer than the head; bristles at posterior angles rather short, the inner one of each pair longer than the outer, and about 0·4 as long as the prothorax. Upper vein of fore-wing with 3 or 4 setæ (1+0 (or 1)+1+1) in the distal half; in one specimen 4 are placed in the distal third; lower vein with 11 to 15 setæ.

Abdomen only slightly broader than the pterothorax, elongate-ovate.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. AUSTRALIA, Ballarat, Victoria; 3 ♀♀ on *Hypochœris radicata*, 28. i. 15 (*R. Kelly*).

Physothrips longiceps, sp. n.

♀.—Length 1·5 mm.

Colour chestnut-brown; fore tibiæ yellowish distally, margins dark; tarsi yellowish. Antennæ brown, joint 2

distally and 3 rather lighter, the latter inclined to yellowish basally. Fore-wings and cilia yellowish-brown.

Head long, about 0·85 as long as broad and as long as the prothorax; widened just behind eyes, cheeks subparallel; surface transversely striate, and vertex similarly striate. Eyes occupying about 0·5 the length of the head, coarsely facetted; postocular bristles absent; interocellar setæ situated just behind anterior ocellus, minute. Antennæ twice as long as the head; joints 3 and 4 fusiform, 5 and 6 broadly united, and 4 and 5 shortly constricted near base; style short; relative lengths of joints as follows:—11 : 17 : 26 (including stem) : 22 : 18 : 23 : 3 : 3. Forked trichomes on 3 and 4 moderately long.

Prothorax about 0·7 as long as broad; bristles at hind angles about 0·4 the length of prothorax.

Pterothorax large. Legs somewhat stout. Wings reaching to ninth abdominal segment, pointed; setæ moderately long, slender. Fore-wing with three setæ in distal half, viz., one just beyond the second third, and two in distal fifth; lower vein with 14–17 setæ.

Abdomen elongate-ovate, pointed at apex. Bristles on segments 9 and 10 long, slender; 9 with a pair of widely separated dorsal bristles.

♂.—Smaller and more slender.

Tergite 9 with a series of four closely set long setæ disposed practically in a straight line. Sternites 3–7 each with a small depression, gradually diminishing in size; 3 and 4 the largest, elliptical, 5–7 rounded, and 7 the smallest, minute.

Separated from *pallipennis*, Uz., by the long head, the coloration of antennæ and wings, the small depressions in sternites, and the length and disposition of setæ on the ninth tergite in the ♂.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. INDIA, Kulhara, Garhwal, 11,700 feet altitude; in flowers of rhododendron, 5. vi. 10 (*A. D. Imms*).

Physothrips calcaratus, sp. n.

♀.—Size and form much as in *P. vulgatissimus* (*pallipennis*). Colour evidently dark brown, with the fore-tibiæ and ends of the intermediate and hind-tibiæ lighter, and all

tarsi yellowish. Antennæ brown, end of joint 2 and whole of 3 yellowish.

Head transverse, rather long; eyes coarsely facetted, sparsely and minutely setose; ocelli large, interocellar bristles long, placed between the posterior ocelli. Antennæ about 2·3 times as long as the head; joints 1 and 2 broader than any of the succeeding; relative lengths of joints as follows:—10 : 12 : 19 (including stem, which is rather long) : 16 : 12 : 17 : 2·5 : 3. 3 (excluding stem) and 4 subequal, fusiform; 5 narrower than 4 or 6, apex truncate.

Prothorax about 1·4 times as broad as long, and scarcely noticeably longer than head; bristles at hind angles very long, about 0·7 the length of the prothorax, slender. Legs somewhat stout; *fore tarsus with a sharp stout tooth near apex.* Wings longish, pointed apically; fore-wings uniform grey-brown; setæ long and slender, 3 to 5 in distal half of upper vein, namely, 1 just beyond middle of wing and 2 to 4 (1+1, 1+1+1, 2+1, or 2+2) in the distal fifth. Costa with about 25 and lower vein 17 longish setæ.

Abdomen elongate-ovate; apical bristles fairly long, a dorsal pair on 9; tergite 8 with a moderately long close fringe.

At once recognized by the fore-tarsal claw (analogous with *Thrips calcaratus*, Uz.) and the setæ of the upper vein of the fore-wing.

Hab. BOHEMIA; in coll. Uzel mixed with *Odontothrips phaleratus.*

Pseudothrips parvus, sp. n.

♀.—Length about 1·0 mm.

General colour yellow-brown to brown, abdominal segments 9 and 10 darker. Antennæ with first joint greyish, second and fifth to eighth grey-brown, 3, 4, and extreme base of 5 yellow, 4 tinged lightly with grey. Fore-wings wholly light yellowish-brown. Legs yellowish, more or less shaded with grey to brown, especially the femora and outer margins.

Head transverse, about 1·3 times as broad as long, and nearly as long as the prothorax; eyes coarsely facetted. Sixth antennal joint not divided. One prominent prothoracic bristle at each posterior angle and a shorter one just above. Both veins of fore-wing regularly set with setæ, 11 or 12 in each.

Abdomen elongate-ovate, sharply narrowed at apex; posterior margin of eighth tergite sparsely fringed. Apical

bristles of both ninth and tenth segments long; a dorsal series of minor setæ on 9 and a dorsal pair on 10; the latter segment divided above.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. N. QUEENSLAND, Brandon; on a composite flower (? *Helianthus* sp.), 16. x. 14 (*R. Kelly*).

Near *P. glaucus*, Bagn. (a South-African species), from which it may be separated, apart from coloration, by the fewer setæ on veins of fore-wings and the chætotaxy of the apical abdominal segments.

From the Annals and Magazine of Natural History,
Ser. 8, Vol. xvii., *May* 1916.

Brief Descriptions of new Thysanoptera.—VIII.

By Richard S. Bagnall, F.L.S.

Suborder Terebrantia.

Family Æolothripidæ.

Subfamily *Orothripinæ.*

Orothrips propinquus, sp. n.

♀.—Very like *O. australis*, Bagn., but stouter and larger (1·8 mm. long as against 1·5 mm.) and also darker in coloration. The head is shorter than the prothorax; the maxillary palpi are distinctly 8-jointed, whilst the antennal joints 3 and 4 are practically subequal, the relative lengths of joints 3 to 9 being as follows :—

O. propinquus, sp. n., 108 : 102 : 51 : 39 : 28 : 20 : 15.
O. australis, Bagn., 104 : 82 : 52 : 32 : 24 : 18 : 12.
O. tenuicornis, sp. n., 165 : 126 : 66 : 48 : 50 : 30 : 19.

All legs dark grey-brown; fore-tibiæ and tarsi a shade lighter—yellowish-grey-brown. Colour of antennæ as in *O. australis*. Fore-wings broader than in *O. australis*, with the brown markings across middle and tip occupying only about 0·20 and 0·15 of the total length, the comparative extent of areas being as follows :—

	propinquus.		*australis.*		*tenuicornis.*	
	Fore-margin.	Hind-margin.	Fore-margin.	Hind-margin.	Fore-margin.	Hind-margin.
Clear	9·0	8·0	5·0	4·5	6·0	6·0
Dark	3·5	5·5	5·5	6·0	6·5	6·0
Clear	5·0	3·0	2·0	2·5	3·5	3·0
Dark	2·5	3 5	3·5	3·0	3·0	4·0
Comparative length .	20		16		19	

Setæ on veins of fore-wings minute.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. Australia, Creswick, Victoria; on sweet pea, ♀s only, 17. i. 15 (*R. Kelly*).

Orothrips tenuicornis, sp. n.

♀.—Near *O. propinquus*, colour of abdomen lighter, and apical abdominal bristles shorter and more slender. Antennæ more slender and the third joint long, clear lemon-yellow.

Relative lengths of antennal joints and of the areas of fore-wing (which latter approximate *australis* more than *propinquus*) as shown in tables under description of *O. propinquus*. Maxillary palpi 7-jointed.

Setæ on veins of fore-wings minute.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. AUSTRALIA, Healesville, Victoria; 3 ♀s from flowers of *Erythræa australis*, December 1913 (*A. E. Shaw and R. Kelly*).

Family **Thripidæ.**

Pseudothrips achætus, sp. n.

♀.—Length 1·1 to 1·2 mm.

Chestnut-brown; fore-legs yellow, femora tinged with grey-brown and tibiæ lightly with grey; intermediate and hind legs brown shaded with grey, tibiæ yellowish distally; all tarsi yellowish. Antennæ with joint 1 light grey-brown, 2 concolorous with head, 3 yellowish-brown, 4–5 yellowish-brown to grey-brown and 6 to 8 grey-brown to brown. Fore-wing yellowish-brown, a shade lighter at base.

Head transverse, about 0·6 as long as broad; eyes large, not bulging, somewhat coarsely facetted, pilose; ocelli large; no post-ocular or interocellar bristles. Antennæ longer and more slender than in *parvus*, Bagn., about 2·3 times the length of the head; relative lengths of joints approximately as follows:—7 : 12 : 17 (including stem) : 15 : 13 : 17½ : 3 : 4.

Prothorax scarcely longer than the head, and about 0·6 as long as broad; hind margin with a series of moderately stout setæ, but no prominent bristles at hind angles. Wings pointed at apex; both veins of fore-wing regularly set with setæ.

Setæ at apex of abdomen stouter than in *P. parvus*, a pair of short curved dorsal setæ on 9, and posterior margin of tergite 8 not fringed.

♂.—Smaller, lighter, all legs yellowish marked with brown; sternites apparently without transparent areas.

Easily separated from *P. parvus*, Bagn., by the dark colour of body, the comparatively shorter head, longer and more slender antennæ, and the absence of prothoracic bristles.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. S. AUSTRALIA, Mt. Lofty Range, Adelaide; amongst a tube of thrips from flowers of *Acacia myrtifolia* and *Epachris impressa*, Aug. 9, 1914 (*E. B. Poulton*), Reg. 41.

Genus PHYSOTHRIPS, Karny.

a. *Seticollis* group.

Physothrips setipennis, sp. n.

This species is very closely related to the Western Australian species, *Physothrips seticollis* (Bagn.). The antennæ are brown except joint 3 which is clear yellow, and the base of 4 yellowish.

Head as long as or slightly longer than the prothorax. Antennæ about 2·25 times the length of the head, longer than in *seticollis*; relative lengths of joints as follows:—12 : 16 : 27 (with stem) : 26 : 15 : 22 : 3 : 4.

Prothorax with the bristles at hind angles (which are exceptionally slender and light in colour in *seticollis*) somewhat stout and dark, about 0·65 the length of prothorax; surface somewhat closely and irregularly set with minute setæ. In *seticollis* these setæ are regularly disposed (including three widely-seated pairs down the centre), stouter and about twice the length.

Apical abdominal bristles distinctly stouter and darker; ninth tergite with a pair of rather short dorsal bristles, moderately widely separated and the posterior margin of the eighth tergite with a close and moderately long microscopic fringe.

Upper vein of fore-wing regularly set with setæ for the whole length as in *seticollis.*

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. AUSTRALIA, Healesville, Victoria; on cultivated white briar, 25. i. 14 (*R. Kelly*).

b. ? group.

Physothrips flavidus, sp. n.

♀.—Exactly as in *Thrips flavidus*, sp. n., but having the antennal style 2-segmented.

In this case the type is distinctly of the genus *Thrips*, and closely allied to *T. flavus*, Schr., and this as well as *Physothrips albipes* are named in the genus *Physothrips* as well as

in *Thrips* to avoid confusion by other workers who may receive only one or other of the two forms. Further material may enable us to write upon this curious phase, so far only noticed in Japanese material.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. JAPAN, Kobe; 1 ♀ with *T. flavidus*, sp. n., June 1915 (*J. E. A. Lewis*).

c. *Pallipennis* group.

Physothrips pallipes, sp. n.

♀.—Length 1·1–1·3 mm.

Head and thorax brown lightly tinged with grey, abdomen black-brown. Antennal joints 1 grey-brown, 2 brown, 3 clear yellow, 4 to 8 brown, with 4 yellowish at extreme base and 5 inclined to be lighter at base. Legs yellow, the fore-femora lightly and the intermediate and hind femora more strongly shaded with grey-brown. Outer margin of the fore and intermediate tibiæ shaded with grey-brown, and the hind tibiæ with grey in some specimens. Fore-wings dark smoky-grey, basal fourth light grey.

Head about 0·65 as long as broad, broadest across cheeks which are gently arched; eyes large, coarsely facetted, pilose. Ocelli large, anterior one protected by a pair of rather short setæ. Antennæ about 2·5 times as long as the head; joints 3 and 4 fusiform; relative lengths of joints as follows:— 18 : 32 : 48 : 45 : 30 : 42 : 5 : 5.

Prothorax about 1·2 times as long as the head, about 0·7 as long as broad; surface sparingly setose; hind margin depressed; bristles at posterior angles stout, rather short, not much more than 0·4 the length of the prothorax. Setæ on fore-wings rather long; three widely spaced setæ in distal half of upper vein; lower vein with a series of 15–18 and costa with about 30.

Apical abdominal bristles moderately long, a short dorsal pair on segment 9; posterior margin of tergite 8 with a short irregular fringe.

Easily separated from *P. vulgatissimus* (*pallipennis*) by the coloration of body, legs, and wings.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. Japan, Kobe Harada ; on chrysanthemum, 15. xi. 15, Reg. 128 and 129 ; Kobe, vi. 15, Reg. 126 (*J. E. A. Lewis*).

Physothrips albipes, sp. n.

♀.—Exactly the same as *Thrips albipes*, Bagn., but with the antennal style 2-segmented. Somewhat closely related to *P. pallipes*, sp. n.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. Japan, with *Thrips albipes*, Bagn., Okinawa, Luchu Isl., on nasturtium, v. 13 ; Kobe, vii. 13 (*J. E. A. Lewis*).

Dendrothrips sexmaculatus, sp. n.

♀.—Length 0·6 to 0 7 mm.

Like *D. degeeri*, Uz., but smaller, approaching *D. saltatrix*, Uz., in size.

Head, prothorax, pterothorax, and abdominal segments 1, and 7 to 9 dark chestnut-brown ; abdominal segment 10 lighter, 2 and 3 grey-brown, 3 posteriorly and 4 to 6 light yellow to greyish-yellow, the latter three segments each with a pair of dark brown spots. Wings dark grey with the distal fifth (0·2) white or clear. Legs brown to grey-brown, hind tibiæ inclined to be lighter ; all tarsi yellowish.

Surface of head near base irregularly striate, inclined towards reticulation ; prothorax sparingly and minutely setose. Antennæ about 2·5 times the length of the head. Segment 1 light grey-brown, short ; 2 dark chestnut-brown, globular, bigger and much broader than any of the others ; 3 and 4 yellowish, with the slightest tinge of grey ; 5 greyish-yellow shading to grey distally ; 6 to 8 grey-brown ; 3 and 4 subequal, relative lengths of segments 4 to 8 approximately as follows :—10 : 11 : 11 : 4 : 4 ;—6 narrowing to style and narrower than 5, not divided.

Separated from *D. degeeri*, Uz., by the white band at base of wings, the entire sixth antennal joint, the coloration of antennæ and body, and the smaller size ; and from *D. saltatrix*, Uz., by the white band at base of wing, the shorter intermediate antennal joints, and the coloration of body, &c.

Type. British Museum of Natural History.

Hab. Ceylon, Peradeniya, No. 47/13 (*A. Rutherford*) per the Bureau of Entomology. Reg. no. 240.

Genus EUCHÆTOTHRIPS, nov.

Head not quite as long as broad, *broadest anteriorly*; *vertex broadly rounded*, with antennæ seated below; *a dorso-lateral hump or prominence behind each eye.* Maxillary palpi apparently 3-jointed. Antennæ with single-jointed style, 7-jointed.

Prothorax about as long as the head, *a pair of long mid-lateral bristles* as well as those at posterior angles; *antero-marginal setæ rather long.* Wings as in *Thrips* s. s. *Outer margins of all tibiæ with a pair of long outstanding slender hairs or bristles near apices and one or two, not quite so long, near middle.*

Abdomen sharply narrowed from segment 8 to apex, terminal bristles long and strong.

Nearest *Thrips* (*Bagnallia* group), but characterized at once by the italicized features in above diagnosis.

Type. *Thrips króli,* Schille.

Genus THRIPS s. s.

a. *Flavus* group.

Thrips flavidus, sp. n.

♀.—General colour, shape, and size as in *Thrips flavus*, Sch. (as described by Uzel). Antennæ about 2·5 times as long as the head; first joint white, 2 deep yellow tinged with grey; 3 lighter yellow with distal third grey-brown; 4 dark grey-brown, yellow basally; 5 dark grey-brown with basal three-fifths (0·6) sharply light yellow; 6 dark grey-brown, inclined to be yellowish basally in some specimens; style dark grey-brown. Relative lengths of segments 3 to 7 as follows :—30 : 28 : 20 : 28 : 7.

Prothorax about as long as head, more transverse than in *flavus*; setæ at hind angles shorter than in *T. flavus* (16 as to 23). Apical abdominal setæ much as in *T. flavus*, but relatively shorter.

♂.—Smaller and more slender, whitish. Antennal joint 6 with the basal two-fifths (0·4) distinctly yellow. Eighth tergite with a weakly arcuate series of long slender setæ.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. JAPAN, Kobe, June 1915 (*J. E. A. Lewis*).

b. *Physopus* group.

Thrips griseus, sp. n.

♀.—Size and general form as in *T. physopus.*

Dark grey to grey-brown; fore-tibiæ light yellow shaded on their outer margins with grey-brown; all tarsi yellowish; fore-wings entirely grey, hind-wings lighter. Antennæ grey-brown, joint 3 yellowish and 4 brownish-yellow basally. 5 lighter at extreme base.

Head as in *T. physopus*, transverse, with cheeks widest behind eyes and thence converging to base. Ocelli rather large. Antennæ much as in *T. physopus*, but with the intermediate joints comparatively stouter; relative lengths of joints 3 to 7 approximately as follows:—20 (with stem): 17 : 12 : 19 : 6.

Prothorax wider than and at least as long as the head, 1·7 times as broad as long; bristles at hind angles moderately long and stout, 0·45 the length of the prothorax. Legs moderately stout, hind tibiæ with a double row of six spines to apex within. Setæ on costa and veins of fore-wings as in *T. physopus*, dark.

Bristles at apex of abdomen dark, long and strong, twice as long as the segments carrying them; a short and not very strong dorsal pair on segment 9. Posterior margin of tergite 8 with a short fringe, the cilia apparently running in pairs; segment 10 divided above.

Sharply distinguished from *T. physopus* by the coloration and form of antennæ, and the colour generally.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. JAPAN, 2 ♀s, Kobe, vi. 15 (*J. E. A. Lewis*).

Suborder TUBULIFERA.

Family **Idolothripidæ.**

Genus GIGANTOTHRIPS, Zimmermann.

1900. *Gigantothrips*, Zimmermann, Bull. de l'Inst. Bot. de Buitenzorg, No. vii.
1908. *Panurothrips*, Bagnall, Trans. Nat. Hist. Soc. Northumberland & Durham, n. s. iii. p. 208.

Gigantothrips gracilis, Bagnall.

Panurothrips gracilis, Bagnall, *l. c.* p. 208 (1908).

This species is closely relately to *Gigantothrips elegans*,

Zimm., but compared with specimens of the latter in my collection (*ex et teste* Karny), *gracilis* is larger and has the tube very noticeably longer, about 0·5 as long again as in *elegans* (18 : 12); viz., in *gracilis* about as long as the abdominal segments 7–8 together, and in *elegans* about 0·75 the length of those segments.

Genus ELAPHROTHRIPS, Buffa.

Idolothrips, Hinds, Bagnall, and others.
Elaphrothrips, Buffa, Redia, v. p. 162 (1909).

Genus IDOLOTHRIPS, Haliday.

Idolothrips, Froggatt, Proc. Linn. Soc. N.S.W. 1904, pt. 1.
Acanthinothrips, Bagnall, Trans. Nat. Hist. Soc. Northumberland & Durham, n. s. iii. p. 207 (1908) (and others).

Mr. Froggatt is undoubtedly right in assigning *Idolothrips marginata* and *spectrum* as ♀ and ♂ of the one species, and I withdraw anything I may have written in 1908 on that point. I do not agree with him, however, in that *I. lacertina*, Hal., is a "smaller and more variable form of the ♂" (*spectrum*). Regarding the female *marginata* as the genotype of *Idolothrips*, I erected the genus *Acanthinothrips* for the strongly characterized species *spectrum*, but being sexes of one species they must be placed in the genus *Idolothrips*, and the *Idolothrips* of most modern authors must be known as *Elaphrothrips*. The females of the two genera are very much alike.

Idolothrips marginata, Haliday.

1852. *Idolothrips marginata*, Haliday in Walker, Homopt. Ins. Brit. Mus. p. 1096.
1852. *Idolothrips spectrum*, Haliday in Walker, Homopt. Ins. Brit. Mus. p. 1097.
1904. *Idolothrips spectrum*, Froggatt (with *marginata* (♀) and *lacertina* as synonyms), Proc. Linn. Soc. N.S.W. pt. 1, p. 54.

I. marginata, being the first used, would seem to be the name by which this species should be known.

Idolothrips lacertina, Haliday.

1852. *Idolothrips lacertina*, Haliday, *l. c.* p. 1097.
1904. *Idolothrips spectrum* (in part), Froggatt, *l. c.* pt. 1, p. 54.

The ♂, apart from being noticeably much smaller and more slender than the ♂ of *marginata*, widely and constantly

differs in the structure of the lateral abdominal processes, as may be seen by the accompanying table and rough figures.

	I. spectrum, ♂.		*I. lacertina*, ♂.	
Process on segment	Approximate length of process.	Approximate length of spine or bristle compared with length of process.	Length of process.	Length of spine or bristle.
2	5 times as long as breadth at apex.	*Spine* 0·3 as long.	As long as breadth at apex.	*Spine* 2·0 as long.
3	4·5 " "	*Spine* about 0·45 as long.	About 2·0 as long.	*Bristle-spine* 3·0 as long.
4	4 " "	Slender *spine* 0·8 as long.	About 1·5 as long.	*Bristle* 6·0 as long.
5	3 " "	*Bristle* 3·0 as long.	As long.	*Bristle* 6·0 as long.
6	3·5 " "	*Bristle* 2·5 as long.	Slightly longer than.	*Bristle* 6·0 as long.
7	4 " "	*Spine* about 0·5 as long.	About 2·0 as long.	*Bristle* 4·0 as long.
8	5·6 " "	*Spine* about 0·35 as long.	About 2·5 as long.	*Spine* about as long.

Fig. 1. Fig. 2.

Fig. 1.—*Idolothrips marginata*, Hal., ♂.
Fig. 2.—*Idolothrips lacertina*, Hal., ♂.

Left lateral processes of second (*a*), third (*b*), and eighth (*c*) abdominal segments.

In *lacertina* the head is shorter compared to its breadth and the genal spines are fewer, shorter, and less strong than in *marginata* (♂), whilst the third antennal joint is approximately as long (compared to 1·25 times as long in *marginata*) as the length of head behind eyes. The surface-setæ of tube are, on the other hand, slightly longer and stronger compared to the breadth of the tube than in *marginata*.

I have an abundant material of these interesting insects, chiefly through Mr. Kelly's kindness, and hope in the near future to make close descriptions of the two species.

Family **Megathripidæ**.

This family will probably have to be reduced as a subfamily of Idolothripidæ.

Megathrips quadrituberculatus (Bagnall) *.

1908. *Idolothrips quadrituberculatus*, Bagnall, Trans. Nat. Hist. Soc. Northumberland & Durham, n. s. iii. p. 210, pl. vii. fig. 9.

A female example sent to me by Mr. Lewis in 1912 is certainly the species I described as *Idolothrips 4-tuberculatus*; the tube is present and suggests that the species is a Megathripid. In 1915 I received a ♂ *Megathrips* which despite certain colour-differences is presumably the ♂ of the same species.

♀.—Length (including tube) 5·0 mm.

Sixth antennal joint (not described in type) with basal half yellow; 7 and 8 black. Antennæ twice as long as the head (which latter is very slightly produced beyond eyes); very slender, excepting the two basal joints; relative lengths of joints 3 to 8 as follows:—64 : 53 : 43 : 32 : 17 : 15. Joint 2 constricted near base and curved outwards.

Tube long, 1·8 as long as the head, slightly curved upwards before apex; about 6 times as long as broad near base, and with tip about 0·45 as broad as at base; sparingly furnished with fine backwardly directed setæ. Bristles at apex broken off.

♂.—Length (including tube) 4·5 mm.

A darker specimen than the ♀. Fore-tibiæ brown excepting at apex and basally; intermediate tibiæ brown except

* In a footnote to a paper on some Japanese Thysanoptera Dr. Karny mentions eight then-known species, and refers to this as *Idolothrips tuberculatus*. I mention this error to avoid confusion, as Hood has described an *Idolothrips* under that name from U.S.A.

at apex, and hind tibiæ brown except the extreme base and distal third which are yellow. Antennæ more than twice as long as the head; relative lengths of joints 3 to 8 as follows:—61 : 50 : 45 : 33 : 16 : 14.

Abdominal segment 6 furnished with a pair of lateral spine-like tubiform processes at anterior angles, slightly outwardly directed but scarcely curved, and not quite reaching the line of the posterior margin; 8 with a pair of lateral tooth-like processes near posterior angles.

Tube about 1·5 times as long as head, stout near base but sharply constricted in the first fourth; more strongly setose (and with longer setæ) than in the ♀. Terminal hairs short.

Hab. JAPAN, Kobe, 1 ♀, 1912; 1 ♂, April 1915, the latter Reg. no. 139 (*J. E. A. Lewis*).

Family **Phlœothripidæ** s. l.

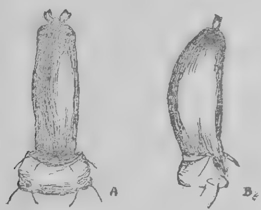
a. *Docessissophothrips* group.

Docessissophothrips longiceps, sp. n.

♀.—*Forma aptera.* Length about 5·5 mm.

Colour deep blackish-brown, second antennal joint reddish-brown (rest of antennæ broken off in the unique specimen); all tibiæ orange-yellow, tarsi clouded with brown.

Fig. 3.



Head and prothorax of *Docessissophothrips longiceps*, sp. n.
A. Viewed dorsally. B. Viewed laterally.

Head more than 4·5 times as long as the prothorax and 2·7 times as long as broad at middle; dorsum gently arched in profile. Eyes small, finely facetted, not prominent; post-ocular bristle apparently absent.

Fore-margin of prothorax strongly emarginate; bristles moderately long, colourless. Pterothorax short; wings absent.

Abdomen much as in *D. major*; tube long, about 0·72 the length of the head, about 5·0 times as long as broad near base, narrowed in the distal fifth, the apex being about 0·6 as wide as near base; surface sparsely and minutely setose.

At once separated from *D. major* by the length of the head, the non-prominent eyes, and the coloration of the tibiæ.

Type. British Museum of Natural History.

Hab. 1 ♀, Madeira (*Wollaston*).

This makes the sixth species of the genus, each as yet known from but a single example. Ignoring *D. monstrosus*, which becomes the type of a new genus characterized below, the remaining five species fall into two well-defined groups as follows:—

1. Length 3·0 mm. or under, head shorter and broader, less than twice as long as broad; containing *ampliceps*, Bagn., and *laticeps*, Bagn.
2. Length more than 5·0 mm., head longer and 2 to 3 times as long as broad; containing *major*, Bagn., *frontalis*, Bagn., and *longiceps*, sp. n.

Genus Egchocephalothrips, nov.

Separated from *Docessissophothrips*, Bagn., by the extreme form of the head which, viewed dorsally, is as figured in the original description of *D. monstrosus*. It is extraordinarily adpressed and, viewed dorsally, represents the end view of a stoutish "plate," with a slight swelling (representing the cheeks) on each side of the marked carina.

Type. *Docessissophothrips monstrosus*, Bagnall.

b. *Trichothrips* group.

Œdemothrips (?) *propinquus*, sp. n.

♀.—Length 1·8 mm.

Colour brown, the last 4 or 5 abdominal segments darker. Legs yellowish shaded with light grey-brown. First antennal joint light yellowish-brown, 2 slightly darker, 3 brown with basal half clear yellow, 4 and 5 brown with basal thirds yellowish, 6 to 8 totally brown.

Almost the same as *Œdemothrips* (?) *brevicollis*, Bagn. (Japan) in general form. The head is not quite so markedly convergent behind, the prothorax is not so short compared to its breadth, and the tube is stouter.

Antennæ about 2·4 times the length of the head ; relative lengths of joints 3 to 8 approximately :—31 : 29 : 28 : 24 : 19 : 14.

Prothorax about twice as broad as long ; setæ at posterior angles widely spaced, somewhat short and stout ; the outer longer than the inner, about 0·4 the length of the prothorax.

Tube short and stout, about 0·9 as long as the head ; 1·45 times as long as broad at base, and 0·45 as broad at tip as at base ; terminal bristles light coloured, about 0·7 the length of the tube.

Very closely allied to *brevicollis*, but at once recognized by the coloration of the body and the antennæ.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. AUSTRALIA, Badger Weir, Healesville, Victoria ; 1 ♀ on clover, 6. iv. 15, Reg. 120 (*R. Kelly*).

c. *Leptothrips* group.

Gynaikothrips uzeli (Zimmermann).

1909. *Leptothrips flavicornis*, Bagnall, Trans. Nat. Hist. Soc. Northumberland & Durham, n. s. iii. pt. 2, p. 528, pl. xiv. figs. 6–8 (from Madeira).
1909. *Phlœothrips longitubus*, Bagnall, *l. c.* n. s. iii. pt. 2, p. 534, pl. xiv. figs. 21 & 22 (from Java).
1910. *Leptothrips flavicornis*, Bagnall, Ann. Soc. Ent. Belg. liv. p. 464 (from *Ficus carnosa*, Madeira).
1910. *Leptothrips longitubus*, Bagnall, *l. c.* liv. p. 464 (rectification of generic position).

I have long been aware of the identity of the Madeiran *Leptothrips flavicornis* and the Javanese *L. longitubus* with Marchal's *Phlœothrips ficorum* from Algeria, and I was surprised that the above were not included in Hood's lengthy list of synonyms in *Insecutor Inscitiæ Menstruus* (1912, i. p. 153). I was under the mistaken impression, however, that I had published a note on the synonymy, and now rectify the omission.

d. *Haplothrips* group.

Cephalothrips hispanicus, sp. n.

♀.—*Forma aptera.* Length 1·3 to 1·4 mm.

Grey-brown, head and first two antennal joints chestnut-brown ; fore-femora yellowish at inner margin, fore-tibiæ

yellow clouded with grey to grey-brown basally and along outer margin; intermediate and hind tibiæ shading to yellow distally; all tarsi yellowish with brown spot. Antennal joint 3 lemon-yellow, 4 to 6 yellowish to light brownish-yellow; 7 and 8 light brown.

Head about 1·3 times as long as wide across eyes, widest just below the middle; cheeks broadly arched; eyes slightly protruding, coarsely facetted, occupying about 0·35 the total length of head and each about 0·25 the breadth. Vertex raised; ocelli large, posterior pair on a line across the anterior third of eyes; anterior ocellus forwardly directed; postocular setæ short, inconspicuous. Antennæ about 1·7 times the length of head, rather stout; joint 3 obconical, narrower than 2 or 3 to 5, 6 and 7 somewhat broadly and 7 and 8 broadly united; relative lengths of segments approximately as follows:—8 : 15 : 14 : 15 : 16 : 15 : 12 : 8. Mouth-cone reaching about 0·7 across prosternum; apex blunt; joint 1 of maxillary palpus short, about 0·2 the length of 2.

Prothorax about 0·75 the length of head and about twice as broad as long. All setæ present, colourless and therefore difficult to discern; the pair at posterior angles largest, 0·4 the length of prothorax. Pterothorax slightly broader than width across fore-coxæ, about as long as broad; wings absent; legs rather short and stout; fore-tarsus with a minute, sharp, but broad-seated tooth.

Abdomen not much broader than pterothorax; elongate; roundly narrowed from segment 7 to base of tube. Tube about as long as the prothorax, 0·65 as broad at apex as at base, sides gently and evenly narrowed from near base; terminal hairs about as long as tube, colourless except for basal third or thereabouts. Abdominal setæ on segment 9 about 0·8 the length of tube, other setæ shorter; all colourless and inconspicuous. Wing-retaining setæ on tergites 2 to 7.

Separated from *C. monilicornis* (Reuter) by the smaller size, shape, and coloration of the antennæ, and the shape and modest or normal proportions of the head. It should be noted that the *Cephalothrips yuccæ* of Hinds cannot be regarded as congeneric with *monilicornis* or *hispanicus*.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. Spain, Zaragosa ; 2 ♀s collected (with other interesting Thysanoptera) by the well-known neuropterist, Father Navas, S.J., 8. iv. 13.

Rhopalothrips froggatti, sp. n.

♂.—Length about 0·75 mm.

Apterous ; short and broad.

Uniform brown, distal third of fore-tibiæ and extreme apices of intermediate and hind tibiæ yellowish-white ; tarsi yellowish marked with brown ; apex of antennal joint 2 and whole of 3 yellowish, 4 and 5 a trifle lighter brown than 6 to 8.

Head much as in *R. bicolor*, Hood, but with the outline of eyes merged in the cheeks ; scarcely wider at base (where it is widest) than long ; ocelli absent ; postocular bristles short, broad apically, apparently infundibuliform. Antennæ short and stout, about 1·7 times as long as the head, shaped as in *R. bicolor*, but joint 6 distinctly constricted at base forming a short stem.

Prothorax transverse, 0·6 as long as the head, and 2·8 times as broad as long ; all usual setæ apparently present, colourless, short, and infundibuliform. Pterothorax short, transverse, only slightly broader than the prothorax. Legs short and stout ; fore-tarsal tooth strong, sharp.

Abdomen short and broad, narrowing evenly from segment 4 to tube ; segments—especially 1 to 8—very strongly transverse ; segment 4 about 7 times and 7 about 5 times as broad as long. Tube very short, broad, 0·5 the length of the head, about 0·8 as broad at base as long and 0·6 as broad at apex as at base ; terminal hairs pointed, colourless, and about 0·6 the length of the tube. Abdominal setæ short, colourless, infundibuliform.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. Australia, Upper Mangrove, N. S. W. ; 1 ♂ and larvæ from glands on the foliage of the black wattle (*Acacia decurrens*), Sept. 7th, 1900 (*W. W. Froggatt*).

This, the smallest described species of the suborder, is one of an interesting collection of Tubuliferous Thysanoptera (chiefly Gall-causers) made by Mr. Froggatt, upon which we propose to publish a joint paper ; and I have chosen to describe it now, firstly, that I may name it in Mr. Froggatt's

honour, and, secondly, on account of its general interest in the light of Mr. Reginald Kelly's * recent paper "Observations on the Function of Acacia Leaf-glands," wherein he mentions that microscopic insects, some white (? larval) and others brown, are sometimes found in the so-called "glands."

R. froggatti, apart from its minuteness, may be distinguished by its very broad form, the broad intermediate antennal joints, the very short and broad prothorax and abdominal segments, and the short broad tube, &c.

Rhopalothrips brunneus, sp. n.

♀.—Length about 1·25 mm.

Apterous. Very like *R. froggatti*, larger and more slender. Dark black-brown, fore-tibiæ yellow near apex, other tibiæ and all tarsi as in *R. froggatti*. Antennæ with joint 3 yellow shaded with grey, 4 and 5 light brown, yellowish basally, and 6 with stem yellowish.

Head as in *P. froggatti*, about as wide as long; antennæ 1·8 times as long as the head, intermediate antennal joints not so broad compared to their length as in *froggatti*.

Prothorax 0·75 as long as the head and 2·25 times as broad as long.

Abdomen elongate, roundly narrowed from segment 7 to base of tube; segment 4 about 4·5 times and 7 about 3·8 times as broad as long. Tube about 0·75 the length of head, nearly twice as long as broad at base and about 0·5 as broad at apex as at base; terminal hairs pointed, a little more than 0·5 the length of the tube.

All setæ as in *froggatti*, but longer.

Type. Hope Department of Zoology, University Museum, Oxford.

Hab. AUSTRALIA, Victoria, on *Acacia dealbata*, 2 ♀s (*R. Kelly*).

Sharply distinguished from *froggatti* by its larger size, deeper colour, the coloration and more slender form of intermediate antennal joints, the less broad form, &c.

The coloration of both *froggatti* and *brunneus* distinguishes them from the genotype, *R. bicolor*, Hood.

* Vict. Nat. xxx., Nov. 1913, pp. 121-127.

ON A NEW SPECIES OF *MELANOTHRIPS* (THYSANOPTERA) FROM TUNISIA.

BY

RICHARD S. BAGNALL, F.L.S.

(*Hope Department of Zoology, University Museum, Oxford.*)

Reprinted from " The Entomologist's Monthly Magazine," 2nd Series, Vol. xxiv.

MELANOTHRIPS NIGRICORNIS, sp. n.

This species is so closely related to *M. fuscus* (Sulz.) that a separate description is unnecessary. It is of a deeper brownish-black colour and has the antennæ unicolorous in both sexes. The colour of the fore-wings is also slightly darker than in *fuscus* and is continued to the extreme base.

The antennæ are more slender and the basal two-thirds of the outer margin of the third joint is distinctly sinuate; joint 4 is distinctly longer than either 3 or 6 in the ♂ as well as in the ♀, and 8 is not so noticeably shorter than 7 or 9 as in *fuscus*.

The spines on head, prothorax, wing-veins and tibia, are darker, apparently stronger, and more noticeable than in *fuscus*, and the hind tibia in both sexes is without the outstanding hairs on the outer margin near base, seen in *fuscus*.

Type: Hope Collections, University Museum, Oxford.

Hab.: Both sexes taken by Mr. P. A. Buxton in the flowers of a *Convolvulus* (? *C. tricolor*) at Djebel Achkel, N.E. Tunisia, 27–iii–1913. I detected this form in a collection submitted by Mr. Buxton to Mr. C. B. Williams, who has kindly made preparations of both sexes and allowed me to describe the species.

The following is a table of the known living species:—

1. Fore-wings with two broad white cross-bands, antennal joints 2—4 light yellow...*M. ficalbii*, Buffa—Italy (Buffa), England (R.S.B.)*

* Journ. Econ. Biol., viii, Sept., 1912.

Fore-wings obscurely brown or yellowish-brown without cross-bands.............................. 2

2. Antennæ darker and slightly more slender ; joint 3 concolorous with others, basal two-thirds of outer margin sinuate ; joint 4 distinctly longer than 3 or 6 in both sexes, and 8 a little shorter than 7 or 9. Fore-wings unicolorous to extreme base. Hind tibiæ without outstanding hairs on outer margin near apex ....*M. nigricornis*, sp. nov.—Tunis.

Antennæ not so black ; joint 3 yellow, outer margin not incurved ; joints 3, 4 and 6 in ♂ practically subequal, and 8 in both sexes very noticeably shorter than 7 or 9. Fore-wing lighter in colour near extreme base. Hind tibiæ (in ♀ at least) with two long outstanding hairs on the outer margin near apex in addition to the usual short spines ....*M. fuscus* (Sulz.)—Europe, Tunis.

October 20th, 1913.

Reprinted from "The Entomologist's Monthly Magazine," 2nd Series, Vol. xxiv.

ON TWO SPECIES OF *HAPLOTHRIPS* NEW TO THE BRITISH FAUNA.

BY

RICHARD S. BAGNALL, F.L.S., F.E.S.

(Hope Department of Zoology, University Museum, Oxford).

I am very pleased to be able to bring the following distinct and interesting species of *Haplothrips* forward as British, both from the neighbourhood of Oxford :—

HAPLOTHRIPS JUNCORUM, *sp. n.*

♀. Length, 2·1—2·35 mm.

Comes nearest to *H. aculeatus.*

Colour very deep brownish black: antennæ and legs as in *H. aculeatus.*

Head about 1·55 times as long as the prothorax and 1·35 as long as broad; slightly narrowed posteriorly. Antennæ only 1·35 times as long as the head. Posterior ocelli widely separated, practically touching inner margins of eyes; anterior ocellus forwardly directed. Postocular bristles weak. Mouth-cone blunt, reaching half-way across the prosternum. Prothorax 1·85 times as broad at hind angles as long. Wings clear, except for a slight touch of brown at extreme base; hind margin of fore-wing with 9—12 cilia (in one case only 7) duplicated near apex.

Abdomen long, not, or only very slightly, broader than pterothorax. Tube 0·9 the length of the prothorax, and 0·6 the length of the head. Apical bristles long and slender, as long as tube and almost colourless, except near tube where they are greyish. In *H. aculeatus* the apical bristles are wholly greyish-brown.

[The following table will help to show the distinguishing characters of the two species at a glance:—

Wings clear. Tube 0·6 the length of the head and only a little more than twice as long as broad at base :

1. Size smaller (length, 1·4—1·6 mm.). Head only slightly longer than broad; antennæ more than 1·5 times as long as the head. Fore-wings with 5—6 duplicated bristles...*H. aculeatus* (Fabr.).
2. Size larger (length, 2·1—2·35 mm.). Head 1·35 times as long as broad; antennæ only 1·35 times as long as the head. Fore-wings with 9—12 duplicated bristles.........*H. juncorum*, sp. n.]

The larva is red, with the head and antennæ, the prothoracic plates, the legs, the basal half of the 8th abdominal segment and segments 9 and 10 grey-brown, though not conspicuously so.

Hab.: Near Yarnton (Oxon.). Not uncommon in all stages on *Juncus* sp., June, 1913.

Type : In coll. Bagnall, University Museum, Oxford.

Haplothrips distinguendus (Uzel).

Monographie der Ordnung Thysanoptera, 1895, p. 239.

This species comes near to *H. statices*, and is sharply distinguished by having the 3rd antennal joint and the basal third of joints 4, 5, and 6 yellow.

The head is shorter, 1·1 times as long as broad, the wings are clear, and the tube about 0·75 the length of the head. In my specimen the 1st antennal joint is grey, and lighter than the second, whilst the tube is distinctly darker than the rest of the body, and the fore-tibiæ are yellow broadly shaded with grey at inner and outer margins. The hind margin of the fore-wing has 14 duplicated cilia near apex. My specimen is 2·2 mm. long, *i.e.*, distinctly larger than Uzel's type.

Hab.: Weston-on-the-Green (Oxon.), one example (♀) by beating sedge-stacks, August, 1913.

The minor differences noted above make it inadvisable to refer the species to *H. distinguendus* with certainty. A series of specimens would enable one to settle the point, and I am hopeful of meeting with it again. Sedge is evidently not its true pabulum.

September 6th, 1913.

DESCRIPTIONS OF SOME NEW SPECIES OF BRITISH *THYSANOPTERA (TUBULIFERA).*

BY

RICHARD S. BAGNALL, F.L.S.

(Hope Department of Zoology, University Museum, Oxford.)

Reprinted from "The Entomologist's Monthly Magazine," 2nd Series, Vol. xxiv.

In the following notes I have pleasure in describing four new and interesting species of *Tubulifera.* Two of these fall into the genus *Hoplandrothrips*—a genus separated from *Phlœothrips, s. str.*, by the presence in the male of two small teeth at the tip of the fore-femur within, and—usually—a similar tooth near the base of the fore-tibiæ within. Representatives are known from Europe, North America, and Africa.

Haplothrips obscuripennis, *sp. n.*

♀. Length, 1·4 to 1·6 mm.

Comes nearest to *H. juncorum*, Bagn., and *H. aculeatus* (Fabr.).

Colour very deep brownish-black, as in *juncorum*; fore-tibia yellowish, shaded with dark grey-brown basally and along the upper and lower margins; intermediate and hind tibiæ lighter at extreme tips; all tarsi yellowish. Antennæ with third joint yellowish, shaded with grey apically, 4 and 5 grey-brown with basal third at least, yellow, somewhat sharply defined; 6 to 8 darker grey-brown, the sixth with basal fourth yellowish.

Head about 1·6 times as long as the prothorax and 1·15 times as long as broad. Cheeks slightly arched. Postocular bristles long. Mouth-cone not

as long as broad at base, reaching half-way across prosternum ; maxillary palpi long. Antennæ 1·6 times as long as the head ; relative length of joints approximately:—8 : 15 : 16 : 16·5 : 16 : 15 : 14 : 11.

Prothorax strongly transverse, 2·25 times as broad across hind angles as long; prothoracic setæ long, especially the pair at posterior angles, pointed. Pterothorax slightly broader than prothorax, longer than broad. Wings light greyish-brown, cilia dark ; fore-wing more markedly obscured from commencement of the marginal ciliation to beyond the middle; dark patch at base. Hind margin of fore-wing with 3–9 cilia duplicated near apex. Fore-tarsus with a minute tooth. Abdomen long, a little broader than the pterothorax. Tube about 0·6 times the length of head, twice as long as broad at base, gently narrowed apically with a slight and gradual constriction just before apex ; apical bristles not quite as long as tube, dark basally but lighter apically. Lateral abdominal bristles yellow ; moderately long, especially those on segments 7 to 9.

♂. Prothorax a little longer than in the ♀, and fore-legs slightly incrassate with each fore-tarsus furnished with a distinct tooth.

This species is separated from both *juncorum* and *aculeatus* by the coloration of the antennæ, the clouded fore-wings, the relatively longer prothoracic setæ, and the shorter and more transverse prothorax. From *juncorum* it further differs in its smaller size, the shorter head and relatively longer antennæ, and from *aculeatus* by its deeper coloration. Its habitat, too, is of a different character.

Type: In Hope Collections, University Museum, Oxford.

Hab.: Amongst dead branches, old pea and bean-sticks, &c. Several examples of both sexes at Hogley bog, near Cowley (Oxon) ; one ♀ at Balsall Common, Warwickshire, September, 1913. Also a single ♀ by general sweeping, near Enslow Bridge (Oxon), 21.ix.13. Both Mr. A. H. Hamm and Mr. Willoughby Ellis have assisted me in securing further examples after my discovery of the species.

Haplothrips cephalotes, *sp. n.*

Length about 1·2 mm.

General colour as in *H. aculeatus*, head deep blackish-brown ; antennæ with 3rd joint yellowish-brown, and the 4th and 5th a lighter grey-brown (or yellowish-grey-brown) than the following; wings clear.

Head about 1·6 times as long as the prothorax, and 1·1 times as long as broad behind eyes. Cheeks gently rounded and converging strongly posteriorly, minutely spinose ; vertex raised in form of hump with the anterior ocellus at apex, facing forwards. Eyes rather prominent, coarsely facetted ; post-ocular bristles only moderately long Posterior ocelli almost touching inner margins of eyes on a line drawn below their anterior third. Antennæ set below vertex, about 1·5 times as long as the head ; joint 3 distinctly shorter than 4, and

narrower than 2, 4, and 5; 4 longer and broader than any of the others. Relative lengths of joints, approximately :—18 : 26 : 26 : 31 : 29 : 27 : 24 : 15. Mouth-cone not quite reaching across prosternum.

Prothorax about twice as broad as long, setæ almost as in *obscuripennis*. Fore tarsus slightly incrassate and armed with a short stout tooth in ♂. Tooth minute in ♀.

Tube about 0·65 times as long as the head, and nearly 2·5 times as long as broad at base; terminal bristles 1·2 times as long as the tube, dark. Lateral abdominal setæ as in *obscuripennis*; yellow.

In type of coloration this species closely resembles *H. aculeatus* though the head is usually noticeably darker than the rest of the body. It is sharply distinguished from *aculeatus* by its smaller size, the noticeably small 3rd and the broad 4th antennal joints, and the distinctly converging head. In the latter respect and in the small third antennal joint, as well as in its small size, *cephalotes* resembles the Japanese *H. oryzæ* (Matsumura), from which it may be readily distinguished by the coloration of the antennæ, the smaller 2nd antennal joint, and the longer head compared to the length of the prothorax.*

Type: In Hope Collections, University Museum, Oxford.

Hab.: Several in sedge stacks, Weston-on-the-Green, August and September, 1913.

(*To be concluded*).

---

* *H. cephalotes* also approaches *H. graminis*, Hood, from which it is at once separated by its size, coloration of antennæ, much shorter and more strongly transverse prothorax, and the long prothoracic setæ. The head, too, is more noticeably convergent posteriorly than in *graminis*.

DESCRIPTIONS OF SOME NEW SPECIES OF BRITISH *THYSANOPTERA* (*TUBULIFERA*), WITH NOTES ON VARIOUS DESCRIBED FORMS.

BY RICHARD S. BAGNALL, F.L.S.

(*Hope Department of Zoology, University Museum, Oxford*).

(*Concluded from Vol.* xlix, *page* 266).

Reprinted from "The Entomologist's Monthly Magazine," 2nd Series, Vol. xxv.

Hoplandrothrips ellisi, *sp. n.**

Length 2·3 to 2·6 mm.

Colour dark grey-brown; fore-tibiæ yellow, shaded with brown basally and along edges; extreme apices of intermediate and hind tibiæ yellowish; all tarsi yellowish; basal half of tube darker than distal half. Antennal joints 1, 2, and

* I find pleasure in naming this and the following species in honour of Mr H. Willoughby Ellis and Mr. J. Collins respectively.

8 concolorous with head; 3 light yellow with apical third touched with grey-brown; 4, 5, and 6 dark grey-brown with basal half, two-fifths and one-third respectively yellow; 7 with extreme base yellowish. Wings clear, except for a very faint smoky tinge about middle; cilia darker.

Head about 1·33 times as long as broad behind eyes, and 1·75 times as long as the prothorax. Cheeks with a few short spines, broadest behind eyes, gently arcuate and as broad before the collar-like thickening at base as across eyes. Eyes finely facetted; post-ocular bristles set well back, longer than eye and very slender. Ocelli fairly large, set on a slight prominence, the posterior pair somewhat close to the inner margins of eyes and on a line drawn through their centre; anterior one directed forwards and protected by a pair of setæ. Mouth-cone reaching about 0·7 way across prosternum.

Antennæ somewhat as in *H. bidens* (Bagn.), about 1·65 times as long as the head; joints 3 and 4 clavate, broader than any of the succeeding. Relative lengths of joints:—14 : 21 : 32 : 31 : 27 : 23 : 20 : 12:—3 sense-cones on 3, 4 on 4, and 2 on both 5 and 6.

Prothorax transverse, twice as broad across hind angles as long; all setæ present, long and blunt, the postero-marginal ones the longest, about 0·7 the median length of the prothorax. Pterothorax as long as broad, broader than width across fore-coxæ; sides of metathorax narrowing to abdomen. Legs somewhat short and stout. Fore-femur strongly incrassate, with a pair of moderately large teeth at apex within; fore-tibia stout and only about 0·6 the length of the femur, apex obliquely produced and inner margin set with a broad-based tooth at about basal third; tarsal tooth long and stout. Fore-coxa with one long blunt hair and several short stout spines. Wings reaching to about 7th abdominal segment, not constricted near middle; cilia long and not very closely spaced, duplicated.

Tube 0·6 the length of head, about 2·2 times as long as broad at base, and about 0·5 as broad at apex as at base; terminal hairs slender, colourless except at base, and a little longer than tube. Bristles on 9th segment not quite as long as tube; tergite with a pair of spine-like setæ near posterior angles, about 0·33 the length of tube. Lateral abdominal bristles on segments 2 to 8 yellowish, with the exception of one pair, blunt or "knobbed," longest on 7 and 8.

♀. A little larger, fore-legs less strongly incrassate and without the femoral and tibial teeth; genal spines more numerous but more minute and therefore less obvious. Post-ocular and prothoracic bristles apparently slightly shorter; pair of spine-like setæ on 9th abdominal tergite absent.

Type: In Hope Collections, University Museum, Oxford.

Hab.: Several ♂ ♂ and one ♀ (slightly immature) taken by beating dead branches, etc., at Balsall Common, Warwickshire, with *Phlœothrips coriaceus*, September, 1913. I owe a nice series largely to

Mr. Willoughby Ellis's energetic assistance—the species was distinctly rare and difficult to get. One ♀ obtained by beating a dead sallow branch near Kirtlington Park (Oxon), 21.ix.13, is apparently referable to this species.

HOPLANDROTHRIPS COLLINSI, *sp. n.*

Length about 1·5 mm.

Colour almost as in *H. ellisi*; antennal joints 6 to 8 wholly dark brown, 3 yellow, brown distally, 4 with basal third and 5 basally yellow or yellowish brown; basal joints greyish near base.

Head only 1·1 times as long as broad, slightly converging posteriorly, genal spines minute. Mouth-cone almost reaching across prosternum. Antennæ 1·7 times as long as head; relative lengths of joints :—12 : 17 : 30 : 27 : 23 : 22 : 18 : 14; 3 and 4 clavate, broader than any of the others; 5 broadly clavate, broader than 6 to 8.

Prothorax and setæ about as in *H. ellisi*. Pterothorax a little broader than long; sides of metathorax converging to abdomen. Hind-legs comparatively a little longer than in *H. ellisi*; fore-legs only moderately crassate, with the pair of teeth near apex of femur within smaller than in *H. ellisi*; tibiæ longer and more slender, without tooth at basal third within; tarsal tooth somewhat short, sharp. Coxæ as in *H. ellisi*. Wings as in *H. ellisi*, 10 cilia duplicated.

Tube 0·6 the length of head; terminal hairs, bristles of 9th segment and lateral abdominal setæ as in *H. ellisi*.

Readily separated from *H. ellisi* by its smaller size, shorter and relatively broader head, and the coloration of the antennæ.

Type: In Hope Collections, University Museum, Oxford.

Hab.: One ♂ taken with *H. ellisi*, Balsall Common, Warwickshire; and another ♂ by beating dead ash branches, Enslow Bridge (Oxon), September, 1913.

The genus *Hoplandrothrips* is apparently composed of numerous somewhat closely allied forms and is known from Europe, Africa, and North America.

The European species *Phlœothrips annulipes*, Reut. (Finland); *minor*, Uzel; *parvus*, Uzel (Bohemia); *brevicollis*, Bagn. (Norway); and *albovittatus*, Schille (Poland), are known from females only, and it is probable that some or all of them should be referred to *Hoplandrothrips*. Of these, *albovittatus* is distinctive on account of the coloration of the prothorax, whilst *annulipes*, *parvus*, *brevicollis*, and *Hoplandrothrips bidens*, Bagn. (Hungary), are separated at once from the species just described by having the intermediate and hind tibiæ yellowish both basally and apically. *P. minor* has the head only slightly broader

than long as in *collinsi*, but the coloration of the antennæ is distinctive, the 5th antennal joint is fusiform, and the tube is nearly as long as the head.

Of the American species, *xanthopus*, Hood, *insolens*, Hood, *uzeli*, Hinds, have the tibiæ yellow; *funebris*, Hood, has the antennæ uniformly brown; *juniperinum*, Hood (somewhat near *collinsi*), has minute prothoracic setæ; and *microps*, Hood, has a peculiarly shaped head with distinctive chætotaxy. *Jennei*, Jones, and *armiger*, Jones, have the innermost pair of bristles on the 9th tergite knobbed, and the antennæ coloured somewhat as in *minor*. *Pergandei*, Hinds, is very near *collinsi*, but has the base of the 6th antennal joint yellow, the pterothorax narrower, and the 5th antennal joint apparently fusiform, whilst *raptor*, Crawford, is not unlike *ellisi*, differing in the shape of the head, the coloration of the antennæ, and in the postero-marginal setæ of the prothorax, which are much shorter than those at posterior angles.

Of the two described African species, *hoodi*, Bagn., is a very distinctive one; *natalensis*, Tryb., is near *collinsi*, differing in its coloration, relative lengths of antennal joints, chætotaxy of abdomen, etc.

Cryptothrips latus, Uzel.

One example and larvæ taken by Mr. Wm. Harvey at Bournemouth, January, 1913. Several examples and larvæ amongst dead branches and old bean sticks, Hogley Bog, near Cowley (Oxon), September, 1913, with an undescribed *Haplothrips*. Previously known as British from a single specimen, without data, in the British Museum.

Cryptothrips major, Bagnall.

Described from a single Norwegian example, Mr. C. B. Williams has had the good fortune of discovering both sexes and larvæ in Surrey and is bringing forward the species.* I have taken larvæ that agree well with those submitted to me by Williams in Oxfordshire and Warwickshire, and possess a single ♂ taken by Mr. J. Collins at Water Eaton (Oxon) in August, 1913.

Cephalothrips monilicornis (Reut.).

Several wingless examples on grass from the Ruskin Reserve, Cothill (Berks), September, 1913.

* Journ. Econ. Biol., December, 1913.

TRICHOTHRIPS SEMICÆCUS, Uzel.

One example from under bark of willow on the banks of the Cherwell, near Oxford, February, 1913.

PHLŒOTHRIPS CORIACEUS, Hal.

With an undescribed *Hoplandrothrips*, by beating dead branches, Balsall Common, Warwickshire, September, 1913 (H. Willoughby Ellis and R. S. B.).

HOODIA BAGNALLI, Karny.

Numerous larvæ and one imago on wych elm, Abingdon; larvæ on wych elm and ash, Cothill (Berks), September. Larvæ on ash at Enslow Bridge and Water Eaton (Oxon), October, 1913.

Oldstead, Park Town,
Oxford: *December 9th*, 1913.

Reprinted from " The Entomologist's Monthly Magazine," 2nd Series, Vol. xxv.

EUTHRIPS TAMICOLA, A NEW SPECIES OF *THYSANOPTERA* FROM THE FLOWERS OF THE BLACK BRYONY.

BY RICHARD S. BAGNALL, F.L.S., F.E.S.

One afternoon towards the end of June I found an ordinary looking black Thrips, with a white band at the base of wings, in some numbers, in the minute flowers of the Black Bryony (*Tamus communis*) in the hedge-side near Yarnton, Oxon. I did not attach much importance to this capture, but upon examination on my return home it turned out to be a new and distinct species of *Euthrips* (*Anaphothrips*), which I describe below. The following evening I cycled along several country roads and lanes in the neighbourhood of Oxford (in the two counties) and took the same Thrips in the flowers wherever the plant was found.

Euthrips tamicola, n. sp.

This species belongs to the section in which the sixth antennal joint is not divided.

♀. Length, 1.4 to 1.5 mm.

Colour, deep blackish brown, all tibiæ and tarsi yellow. Second antennal joint yellowish distally, 3 and 4 yellowish and 5 greyish-brown with the base yellow. Upper wings grey-brown, basal fifth (or thereabouts) white; mid-vein of hind-wings and all cilia fumose.

Head broader than long, 0.7 as long as broad, diverging basally; surface irregularly and transversely striate, sparingly setose. Eyes somewhat prominent, occupying about 0.5 the total length of the head, coarsely facetted and minutely and sparingly pilose. Ocelli on a prominence, large with reddish tinge; posterior pair about on a line through middle of eyes. Antennæ about 2.2 times the length of the head, 6th joint entire; relative lengths of joints approximately :—5 : 12 : 20 (including stem) : 17 : 13 : 18 : 3 : 5. Joint 3 pedi-

cellate, roughly fusiform; 4 moderately clavate, 5 and 6 somewhat broadly united: 3 and 4 with long, slender double trichomes, and 6 with a long, slender, single trichome near outer side of apex.

Prothorax transverse, angles rounded, about 0.6 as long as broad; surface irregularly transversely striate, minutely and sparingly setose; about 0.9 the length of the head.

Pterothorax a little longer than broad, sides of metathorax narrowing towards the base of the abdomen. Legs moderately long, tibiæ somewhat more than usually stout. Wings fully developed, reaching to the eighth abdominal segment; setæ minute, lower vein of fore-wing more or less regularly set, 17 or more to distal fifth; upper vein with four or five near base, 1 near middle, 1 about distal fourth, and 1 at extreme apex; costa similarly set with similar weak setæ. Lower cilia of fore-wing wavy, those of hind-wing rather sparse.

Abdomen elongate-oval, slightly broader than the pterothorax and about 0.6 the length of the entire insect, rapidly narrowing from base of segment 8 to tip; spines on 9 longer than, and on 10 as long as, the 10th segment, which is open above.

Type: In Hope Department of Zoology, University Museum, Oxford.

Habitat: In numbers with its pink larvæ, in the flowers of the Black Bryony *(Tamus communis)*, Yarnton and Cowley (Oxon), and North Hincksey, Boar's Hill and neighbourhood (Berks), June, 1914. Probably a widely-distributed species.

Hylton, near Sunderland:
October 5th, 1914.

[*Extracted from the* Geological Magazine, Decade VI, Vol. I, No. 605, pp. 483–5, November, 1914.]

Fossil Insect in Amber.

On *Stenurothrips succineus*, gen. et sp. nov., an interesting Tertiary Thysanopteron.

By Richard S. Bagnall, F.L.S., F.E.S.

(PLATE XXXVI.)

THE thrips described herein was submitted to me by Professor Branca of the Geologisch-Palaeontologisches Museum, Berlin, and is one of a small collection of three examples in Baltic Amber. The genus is curious on account of the abnormal tube-like development of the tenth abdominal segment, which, however, is open ventrally for its entire length. In the form of the antennæ, so far as can be ascertained from the single example and the structure of the wings, *Stenurothrips* would seem to show affinity with the Neotropical genus *Heterothrips*, and for the present I regard the genus as falling in the Heterothripidæ.

In the generic description I have stated that there is a cross-vein connecting the two longitudinal veins of the fore-wing near the basal third. In this example I *think* I can discern this cross-vein, which is shown somewhat markedly in the figure, but it is open to some doubt. In another species of the same genus now before me, and chiefly separated from the present species by the more minute spines of the fore-wing, the wings are spread out, and this cross-vein is distinctly discernible.

Whilst I have been able, by various lighting arrangements, to obtain a close detailed report of the upper surface, it has been impossible to make out the mouth-parts, the legs, which are tucked under the body, the basal part of tube ventrally, etc., on account of a thick milky cloudiness, which, in a lesser degree, also somewhat

obscures the dorsal surface of the abdominal segments 8, 9, and base of 10, so that it is impossible to describe the arrangement of bristles, shown in the figure as springing from segment 9 with absolute accuracy. The angle of the antennæ makes it impossible to gauge the relative lengths of segments.

Order THYSANOPTERA.

Sub-order TEREBRANTIA.

Family HETEROTHRIPIDÆ, Bagnall.

Genus STENUROTHRIPS, nov.

♀ Head transverse, about as long as prothorax. Antennæ nine-jointed, the first four joints stouter than the succeeding five.

Prothorax transverse, two prominent bristles at each hind angle; mid-lateral pair well developed. Pterothorax well developed. Wings long, fore-wing with two longitudinal veins each uniting with the ring-vein near apex; apparently a cross-vein uniting the longitudinal veins near basal third. Costa and both veins set for whole length with setæ.

Abdomen elongate-ovate, with tenth segment abnormally produced, very elongate, cylindrical, open ventrally for entire length, and longer than the length of head and prothorax together. Segment 9 furnished with long bristles, and 10 with a series of setæ before apex. Ovipositor presumably long and straight.

Type: *Stenurothrips succineus*, mihi.

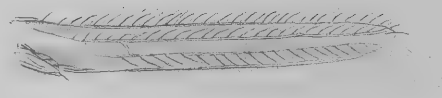
Of living Thysanoptera this form undoubtedly comes near *Heterothrips*, a Neotropical genus, but is strikingly distinguished by the abnormal development of the tenth abdominal segment, the tubiform appearance suggesting a Tubuliferon.

We have noticed several forms distinguished by a similar development, notably *Panchætothrips*, a Heliothripid-like form, distinguished by the form of the explanate margins of abdomen and produced pleurites, and the tube-like tenth abdominal segment, in which there is exhibited a tendency for the ventral opening to close. In this form the ovipositor is styliform and but poorly developed. In *Dinurothrips*, Hood, and *Macrurothrips*, Vuillet, the tenth segment is also strikingly developed.

STENUROTHRIPS SUCCINEUS, sp. nov.

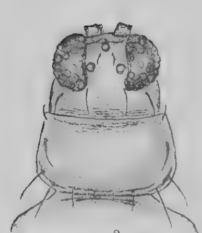
Length about 1·8 mm., breadth of mesothorax 0·35 mm., length of tenth abdominal segment about 0·35 mm.

Head transverse, about 0·75 as long as broad, and as long as or a little longer than the prothorax. Cheeks sub-parallel, dorsal surface near base faintly striate. Eyes large, moderately closely facetted and apparently pilose; greatest dorsal length equal to about 0·75 the total length of head, and space between eyes about 0·4 the greatest breadth across them. Ocelli moderately large, well separated, posterior ones close to the inner margin of eyes; a pair of minute interocular setæ present. Two pairs of rather long backwardly directed setæ on a line behind eyes, practically equidistant, the



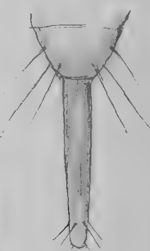
5

1



2

4



3

R. S. Bagnall del.

Bale, Sons & Danielsson Ltd., Imp.

STENUROTHRIPS SUCCINEUS *gen. et sp. nov.*

From Baltic Amber.

inner pair being on a slightly higher plane, one near hind angle of each eye. Antennæ nine-jointed, the breadth of the first four joints, which are finely ringed, being noticeably greater than any of the succeeding and 2–4 sub-equal; joints 5–7 fusiform and apparently sub-equal in length.

Prothorax transverse, nearly twice as broad across posterior third as long through middle; anterior angles obtuse, the hind angles broadly rounded. Surface, anteriorly at least, faintly transversely striate. Each hind angle furnished with two long bristles, about 0·6 the length of the prothorax; a mid-lateral pair backwardly (and slightly inwardly) directed and about 0·45 the length of the prothorax. A series of at least two pairs of postero-marginal setæ.

Pterothorax well developed, much broader than prothorax but not quite as broad as the abdomen at broadest. Wings long, about ten times as long as broad near middle, reaching to about the middle of the tenth abdominal segment, apically somewhat pointed; two distinct longitudinal veins running for the entire length of fore-wing, apparently connected by a cross-vein at about the basal third, and each uniting with the ring-vein near tip. Costa and longitudinal veins uniformly set with moderately long stout setæ, the costa with approximately 45, upper vein 23, and the lower vein 18; a single seta set near apex of wing, just beyond fore-vein but not on it. Setæ as long as or longer than 0·35, the breadth of wing near middle.

Abdomen — excluding segment 10 — elongate-ovate, the ninth segment narrowing to base of 10, which latter is exceptionally elongated, a little longer than the length of the head and prothorax together; ventrally open for its entire length and furnished with a series of setæ just before apex. Ninth segment furnished with four postero-marginal bristles, of which the outer pair is apparently longer than the inner and about 0·5 the length of the tenth segment; also furnished with another and shorter dorsal, dorso-lateral, or lateral pair on a higher plane.

EXPLANATION OF PLATE XXXVI.

FIG. 1. *Stenurothrips succineus*, gen. et sp. nov. × 35.
,, 2. ,, ,, Head and prothorax. × *c.* 70.
,, 3. ,, ,, Ninth and tenth abdominal segments. × 70.
,, 4. ,, ,, Underside of tip of tenth abdominal segment. × 70.
,, 5. ,, ,, Right fore-wing. × *c.* 50.

Formation and locality: from Tertiary Lignite Deposits, shores of the Baltic, extending from Dantzig to Memel, etc.

Stephen Austin and Sons, Ltd., Printers, Hertford.

2. *A* Chalcid *Parasitic on Thrips* (Thysanoptera). *By* Richard S. Bagnall, *F.L.S.*

For some time now Thrips have been regarded as insects of considerable economic importance, and on that account have formed the subject of considerable research. Yet it was only in 1911 that a parasite of any importance was discovered, when Mr. H. M. Russell reared a Hymenopterous insect belonging to the Chalcidæ from the prepupa of *Heliothrips fasciatus* Pergande, which Mr. J. C. Crawford has described as a new genus and species, *Thripoctenus russelli.*

Mr. Russell last year published the results of numerous experiments carried out on this parasite, showing that it reproduces parthenogenetically and would oviposit in the larvæ of several species of Thrips belonging to the sub-order Terebrantia such as *Thrips tabaci*, *Frankliniella tritici*, but would not attempt oviposition in the larvæ of a species belonging to the sub-order Tubulifera, and also refused to oviposit in the young of a bug and of Aphides.

In the same year (1911) G. del Guercio reported upon a Chalcid parasite of a species of Tubulifera, the Olive Thrips (*Phlœothrips oleæ* Costa), which in a later paper he named *Tetrastichus gentilii*, stating that both sexes occurred.

With these exceptions only one other Thrips parasite has been named, when, in 1860, Mrs. Charlotte Taylor described one from Thrips on wheat, under the name of *Pezomachus thripites*, a small, wingless creature, with multi-articulate antennæ and two thoracic nodes. This has not since been recognised.

For some time I have observed a minute black and white Chalcid parasite which I have always regarded as having some connection with Terebrantian Thysanoptera. In August of this year (1913) I found many specimens of this Chalcid in the flowers of the toad-flax (*Linaria*) at Hele Bay, near Ilfracombe, which were obviously interested in Thrips larvæ (*Tæniothrips primulæ* chiefly, and *Physothrips atratus*), and the following morning, by a curious coincidence, I received a long-promised tube of *Thripoctenus russelli* from Mr. Russell. An examination of my captures showed that they belonged to the genus *Thripoctenus*, and almost certainly to the American species, *russelli*, though I propose submitting it to the describer, Mr. Crawford.

British distribution of *Thripoctenus russelli* : August 1913, with *Tæniothrips primulæ* and *Physothrips atratus* in toad-flax (*Linaria*), Hele Bay, near Ilfracombe; with *Oxythrips parviceps* and *Physothrips ericæ* in heather on the Tors, near Ilfracombe, and with *Thrips tabaci*, *Frankliniella intonsa* and *Thrips palustris* in the louse-wort (*Pedicularia palustris*) at Hogley Bog, Cowley, near Oxford.

42

3. *On the Systematic Position of the Order* Protura. p. 531. *By* Richard S. Bagnall, *F.L.S.*

The Order *Protura*, diagnosed by Silvestri in 1907 and monographed by Berlese two years later, on account of its anomalous nature and curious morphological features, has formed the subject of many discourses as to its position in the Arthropod classification.

The important and essential characteristics were reviewed and the views of various authors discussed as to its relationship with the Myriapoda and *Insecta.* The reader deplored the use of the term *Myriapoda* to represent what was not a class but a convenient assemblage of 'many-legged' arthropods, and restricted his remarks to the one so-called Myriapod Order, *Chilopoda*, or Centipedes, highly organised Arthropods coming near to the *Insecta.* He considered that whilst the *Protura* had affinities with the *Chilopoda*, especially *Lithobius*, in the larger number of body-segments and the position of the genital opening, the weight of evidence lay in favour of modifying the classification of the insect, dividing it into two sub-classes, the one to include *Protura*, and the other to include all other Orders of insects.

Reprinted from "The Entomologist's Monthly Magazine," 2nd Series, Vol. xxiv.

SOME INTERESTING BRITISH INSECTS (V).*

BY

F. W. L. SLADEN, F.E.S., R. S. BAGNALL, F.L.S.,

AND

J. E. COLLIN, F.E.S.

The two plates accompanying this article illustrate one species of *Hymenoptera*, two *Thysanoptera*, one *Proturon*, and seven *Diptera*.

Plate II.

Figs. 1, 2.—*Psithyrus distinctus*, Perez (1 ♂, 2 ♀, × $1\frac{1}{2}$). This is an interesting British bumble-bee because, so far as the writer knows, no description of it has been published in England, except that given recently in "The Humble-bee."† The insect was, however, well known to Edward Saunders in his later years, who regarded it as a variety of *P. vestalis* to which, indeed, it is closely related.

The males of the two forms differ in the quality and colour of their coats: in *distinctus* the hairs are less equal in length, and the yellow is paler and more extensive. They may also be easily separated by the structure of the antennæ: the 5th joint in *vestalis* is about as long as, but in *distinctus* much shorter than, the 3rd and the 4th joints taken together; in *vestalis* the flagellum is about 6 mm. long, in *distinctus* it is only about 5 mm. long.

The female of *distinctus* is somewhat smaller than normal-sized females of *vestalis*, and has the yellow band on the anterior part of the thorax and the yellow on the sides of the 3rd abdominal segment paler

* *cf.* (I) Ent. Mo. Mag. XLV, pp. 196, 197, pl. III (1909); (II) XLVI, pp. 1-3, pl. I (1910); (III) XLVII, pp. 203-206, pl. III (1911).
† "The Humble-bee," by F. W. L. Sladen, 1912 (London, Macmillan & Co., Ltd.), pages 210-113.

than in *vestalis.* The yellow thoracic band is never reduced by melanism as it often is in *vestalis.*

Ps. distinctus has been taken by the Rev. F. D. Morice at Rugby, and by myself at Colinton, near Edinburgh. The specimens figured were bred at Dover in a nest of *Bombus lucorum* from a female sent me by Mr. H. L. Orr from the neighbourhood of Belfast. *Ps. distinctus* is probably a fairly common insect in many places in the north of England, in Scotland, and the north of Ireland, and it is probably parasitic on *Bombus lucorum*, which it resembles in the quality and yellow tint of the coat. I have taken only one specimen, a giant male, at Dover. *Ps. vestalis*, on the other hand, is parasitic on *B. terrestris* and resembles the latter in the quality and yellow tint of the coat, and seems to be abundant in the south and east of England, and to disappear altogether in the north.—F. W. L. S.

Fig. 3.—*Trichothrips longisetis*, Bagnall (× 20, drawn from the unique specimen [type] mounted in balsam).

The smallest British species of *Trichothrips*, which in the form of its mouth "cone" occupies with *T. cæspitis*, Uzel, a main division of the genus that may ultimately be treated as distinct.

The single specimen was taken in moss, Gibside, Co. Durham. Another species allied to the polyporus-feeding *T. pedicularis*, viz., *T. propinquus*, Bagn., from the Derwent Valley, was described in the same paper.* Further examples of *T. propinquus* have been taken both in the Derwent Valley and in a wood near Edinburgh, occurring under *Corticium* growing on old beeches. It has not been found in *Polystictus versicolor*, which is the polyporus usually frequented by *T. pedicularius*.—R. S. B.

Figs. 4, 5.—*Megathrips nobilis*, Bagnall (4 ♂, 5 ♀, × 12. Drawn from brachypterous carded specimens). This species was described in 1909 (Ent. Mo. Mag., XLV, pp. 130, 131) from brachypterous specimens of both sexes taken by Dr. Sharp in April and May, 1896, in dried sedge refuse, Wicken Fen, together with its larvæ, and also with larvæ and imagines of a recently recorded British species, *Cryptothrips dentipes*, Reut. The macropterous female of *M. nobilis* was taken in 1910 by Mr. Donisthorpe, whilst Mr. C. B. Williams, who is studying the group, last year found this species in the same habitat together with a distinct and interesting new *Euthrips (Anaphothrips)*.

This year it has been sent me by Mr. C. J. C. Pool from the same locality.

* Trans. Nat. Hist. Soc. Nd. and D'ham, *n.s.* iii, pt. 3, December 1910.

H. Knight and E. Wilson, del.

Fa. Trap, Leiden, lith.

SOME INTERESTING BRITISH INSECTS.

M. nobilis shares with *M. bonannii*, Uzel, the honour of being the largest known European species of *Thrips*, and is recognized by the shape of the head, the shorter tube in the female, and the lateral processes of the 8th abdominal segment (absent in *M. bonannii*) in the male.

Another species of *Megathrips* (*M. lativentris*, Heeger) was taken by Dr. Randell Jackson in Delamere Forest in June, 1907.—R. S. B.

Fig. 6.—*Acerentomon affine*, Bagnall (× 40, rough outline sketch).

This species, which is the largest I have seen, belongs to the family *Acerentomidæ* of the recently diagnosed Order *Protura*, Silvestri (*Myrientomata*, Berlese), an Order of wingless insects without antennæ! It is closely allied to the type of the Order, *A. doderoi*, Silvestri, but Silvestri says that it cannot be referred to his species. I have therefore proposed the name *affine* for it. It occurs in large numbers (I have taken 400 examples) in Gibside, amongst frass under bark of beech, and is also found in the Wear Valley

Members of this Order are really not uncommon in our Islands. I have collected a good deal of material from the North of England, the Forth area, and the neigbourhood of Dundee—comprising several specimens representing the two families and three genera diagnosed by Berlese—and hope to deal with the British species shortly.

For further data see my paper [" Some Primitive British Insects. I.—The Protura "] published in " Knowledge," XXXV, pp. 215, 216, in June, 1912.—R. S. B.

Fig. 7.—*Hammerschmidtia ferruginea*, Fallen. The first record of the occurrence of this species in Scotland appeared on p. 191 of this Magazine for 1912. It is a widely distributed, but distinctly rare, northern insect which has been found in Scandinavia and the mountains of Central Europe, and recorded by Loew as occurring in Manitoba (Canada), and by Williston from the Washington Territory (U.S.A.).—J. E. C.

Fig. 8.—*Callicera yerburyi*, Verrall. Since Colonel Yerbury took the original four specimens at Nethy Bridge (Inverness-shire) in 1904 (v. p. 229 of this Magazine for that year), a few more have fallen to his net in subsequent visits, but the carefully sought for male has so far eluded capture.—J. E. C.

Plate III.

Fig. 1.—*Lophosia fasciata*, Meigen. This very distinct Tachinid

was first recorded as British by Mr. F. C. Adams in this Magazine for 1901, p. 212, from three specimens taken at Lyndhurst (Hants) on July 22nd—24th, and August 1st, 1901; while curiously enough on July 24th of the same year Col. Yerbury caught an example at Parknasilla (Ireland). Since then the species has been taken by the late Mr. Verrall and myself at Wormsley Park (Oxon) in August, 1907; another specimen being found at the same locality by Mr. C. J. Wainwright in August, 1912. It is distinctly rare even on the Continent.—J. E. C.

Fig. 2.—*Chironomus fascipennis*, Zetterstedt. This very little known and pretty species is an addition to the British List, and was found flying over a small piece of ornamental water in the late Mr. Verrall's garden at Newmarket, on August 31st, 1910, and again on August 28th, 1912. It is allied to *C. flexilis*, Wlk., but easily distinguished by the extensively clouded tip of the wing, the sharply defined blackened base of the anterior tibiæ, and the pale middle part of the hind tibiæ.—J. E. C.

Fig. 3.—*Platyphora lubbocki*, Verrall. This species was originally described in 1877 from a specimen bred by Lord Avebury (Sir John Lubbock) from an ant's nest. Since then I believe Mr. J. J. F. X. King has taken it in the New Forest, while the present figure was made from an example found by Dr. J. H. Wood in Herefordshire. A second species, *P. pyrenaica*, Becker, was quite recently (Wien. Ent. Zeit., 1912, p. 330) described from the Pyrenees under the generic name *Psalidesma*. It should be noted that in the figure the minute bristles on the second thick vein are made very much too conspicuous.—J. E. C.

Fig. 4.—*Anthomyza bifasciata*, Wood. This insect was described in the Ent. Mo. Mag. for February, 1911, p. 40, and this is the only record of its occurrence.—J. E. C.

Fig. 5.—*Conops* (*Brachyglossum*) *signata*, Wiedemann. The first and only record of this species as British is that of Mr. J. Collins, who found a pair on September 11th, 1910, in Tubney Wood, near Oxford, as recorded on p. 273 of this Magazine for that year. According to Rondani it is to be found near the nests of *Vespa vulgaris*.—J. E. C.

June, 1913.

[Reprinted from *The Entomologist's Record*, Vol. XXV., No. 9.]

Review of Field Work in 1911.

By RICHARD S. BAGNALL, F.L.S., F.E.S. (*Hope Department of Zoology, University Museum, Oxford*).

During the year 1911 my opportunities for field-work and entomological study were few, and yet the results were more than satisfactory.

As President of the field section of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne, I made a point of not only attending each meeting—sometimes at considerable inconvenience—but of devoting such time as I could to one group of Arthropods, of which little was previously known as regards the local (and indeed the British) fauna and distribution. Happily, I chose the Myriopods, partly on account of the interesting features—so suggestive of *Campodea*—seen in *Scolopendrella*, of which I gathered some hundreds of specimens.

With the exception of a few hours in the New Forest and at Blackgang Chine in the Isle of Wight on the occasion of the British Association Meeting at Portsmouth, my collecting outside field meetings was practically confined to the immediate vicinity of my late home in Penshaw, Co. Durham.

In my Presidential Report to the Society I remarked that altogether the year had been an extraordinarily fruitful one, the additions to the local fauna numbering somewhere between two and three hundred, and the additions to the British fauna being summarised as follows :—One order (PROTURA, Silvestri), four families (*Acerentomidæ*, Silv., and *Eosentomidae*, Berlese, in the *Protura*, *Brachypauropodidae*, Hansen in the *Pauropoda*, and *Brachychaeteumidae* (nov.), Verhoeff, in the *Diplopoda*, several genera, and about sixty species, of which thirteen or fourteen were new to science.

It may prove interesting to make a brief resumé of these captures.

Myriopoda.—The Myriopods, of which over sixty local species were met with, may be taken in their four divisions, the main additions being made by a special study of the small creatures comprising the orders *Pauropoda* and *Symphyla*.

PAUROPODA.—For a long time the two species described by the late Lord Avebury remained alone as British. We now know six in the North, of which *Brachypauropus lubbocki*, Bagnall*, is the first British representative of the *Brachypauropodidae*.

* *Trans. Nat. Hist. Soc. of Northumberland, Durham and Newcastle*, n.s., vol. iv., pp. 59-60, 1911.

Symphyla.—The classical *Scutigerella* (*Scolopendrella*) *immaculata* of Newport remained until recently the sole representative of its kind in this country. In my synopsis* I am able to bring forward thirteen species, many of which have since been found in other localities. *Scutigerella spinipes*, Bagn., *S. biscutata*, Bagn., *S. hauseni*, Bagn., *Scolopendrella dunelmensis*, Bagn., *S. horrida*, Bagn., *S. delicatula*, Bagn., and *S. minutissima*, Bagn., are described as new.

Diplopoda.—I was particularly fortunate in stumbling across several interesting species of Millipedes proper, the additions (not a few of them quite conspicuous creatures) to the British list being as follows:—*Brachychaeteuma bagnalli* (gen. et sp. nov.), Verhoeff, from Gibside, a blind "square-backed millepede," which Verhoeff makes the type of a new family†; the little white Polydesmid, *Titanosoma jurassicum*†, Verh., in numbers from a Wear Valley dene, and sparingly from other parts of the country; *Polydesmus coriaceus*, Porat, from Moles' nests, County Durham; *Microchordeuma* sp. (? *silvestre*), from Gibside; *Isobates varicornis*, C.L.K., from Durham and Northumberland; *Napoiulus* sp. (? *palmatus*, Némec), from a Wear Valley dene, with *Titanosoma*, and the little prettily-marked var. *perplexa* of *Glomeris marginata* from Gibside and Teesdale‡. *Titanosoma jurassicum* was previously only known from a single ♀ found on the Danube, in **1910**; it would seem to be parthenogenetic.

Chilopoda.—Two specimens of *Lithobius* from Gibside were identified by Mr. Edv. Ellingsen of Kragerö, with some hesitation as *L. nigrifrons*, Haase, an addition to the British fauna. It is necessary to obtain more material.

Ectoparasites.—Perhaps the most interesting piece of work attempted during the year lay in the commencement of a study of the Arthropod ectoparasites of the birds and mammals of the North of England, by Mr. Wm. Hall, of Fatfield, County Durham, and the writer. At the end of the year we had listed 4 ticks, including the recently described *Ixodes caledonicus*, Nuttall, from a starling; 28 different fleas, including *Trichopsylla dalei*, Rothsch., in numbers from house-martin's nests; *T. vagabundus*, Wagn., (*insularis*, Rothsch.), from cormorants; *Typhlopsylla dasycnemus*, Rothsch., *T. pentacanthus*, Rothsch., and *Ctenopsyllus spectabilis*, Rothsch., from small mammals; 5 Hippoboscid flies, including the light green *Oxypterum pallidum*, Leach, from the swift; 6 bloodsucking lice (*Anoplura*) from various mammals, and 84 or more bird-lice (*Mallophaga*). This latter material is forming the subject of a series of notes appearing in the *Journal of Economic Biology* and includes 30 or more species not, at that time, recorded as British. In connection with the study of bird-lice, I am of opinion that much remains to be done as regards those that affect the commoner birds; for instance, many of our most interesting discoveries were from birds such as the commoner gulls, cormorant, teal (an apparently new *Trinoton*), starling, blackbird, swift and chaffinch, and I attribute the reason for this to the fact that workers in the Mallophaga have secured their material chiefly from Zoological Gardens, ornithological friends and poulterers, and thus

---

* *loc. cit.*, n.s., vol. iv., pp. 17-41, pl. i., and text figures, 1911.

† *Zool. Anzeiger*, vol. xxxviii., p. 445., 1911, and *Trans. Nat. Hist. Soc., Northumberland, Durham, and Newcastle*, n.s., 1912.

‡ *Zoologist*, July, 1912.

the ecto-parasites, of the rarer birds and game birds have become better known to us than those affecting the common birds.

Protura.—In 1907 Prof. F. Silvestri* diagnosed an order of curious primitive creatures, apterous and without eyes or antennæ, the *Protura*, which stands alone in the Insect World. The Italian species have been beautifully monographed by Berlese†, who regards them as a new Order of Myriopods, the *Myrientomata*. I have had the pleasure of discovering species of the three diagnosed genera falling into the two families of the order, the *Acerentomidae* and *Eosentomidae*, and now that my time can be largely devoted to Zoology, I hope at no distant date to work out our British forms. The species are not really uncommon and are also widely distributed; I have found them in several localities from Dundee southwards.

Apterygota.—In 1910 I collected a good deal of new material in the order *Collembola* (Springtails), including numerous additions to our list, which I have not yet had the opportunity of bringing forward. In 1911 I scarcely did anything in this group with the exception, perhaps, of making other records of some of the species met with in 1910, such as the Neelids, *Megalothorax minimus*, Willem., and *Neelus murinus*, Folsom, the equally tiny *Micranurida pygmaea*, Axels., the curious *Tetracanthella shötti*, Wahl., *Tullbergia quadrispinus*, Börn., *T. krausbaueri*, Börn., *T. calipygos*, Börn. and others.

Thysanoptera.—I cannot conclude this brief review without a few words on my favourite insects, the thrips or *Thysanoptera*, although I was unable to do as much work in the group as in previous years. Two recently described species, *Amblythrips ericae*, Bagn., and *Bagnallia agnessae*, Bagn.,‡ were taken in new localities, including numerous examples of the previously unrecognised male of the latter; Mr. H. S. Wallace, F.E.S., discovered an interesting new species (*Physothrips latus*, Bagn.) at Whitfield, Northumberland, whilst Prof. Karny has shown that the large elm-leaf thrips taken by myself in the Derwent Valley and Teesdale differs from the type of *Liothrips hradacensis*, Uzel (in the Vienna Hofmuseum), to which I had referred the species; it must now be known as *Hoodia bagnalli*, Karny.§ At the Harbottle week-end meeting of the Northumberland and Durham Natural History Society, which I noted in this Journal, *Chirothrips hamatus*, Trybom (*dudae*, Uzel), *Frankliniella tenuicornis*, Uzel, *Bagnallia klapaleki*, Uzel, and *B. dilatata*, Uzel, were recorded as new to the British fauna. One of these, *C. hamatus*, was taken later at Matley Bog in the New Forest, where Mr. C. B. Williams and I had the pleasure of discovering *Cephalothrips monilicornis*, Reut., an insect I had anticipated would be found to occur in our country.

---

* *Boll. Lab. Zool. Gen. e Ag. Portici*, Vol. I., p. 296.
† *Redia*, vi., 1909.
‡ *Journal of Economic Biology*, Vol. VI., pp. 1-11., 1911.
Trans. Ent. Soc., 1912.

[*Reprinted from* 'THE ZOOLOGIST' *for August, 1913.*]
p. 292.

LITHOBIUS DUBOSCQUI, BRÖLEMANN, A CENTIPEDE NEW TO THE BRITISH FAUNA.

BY RICHARD S. BAGNALL, F.L.S., F.E.S.
(Hope Department of Zoology, University Museum, Oxford.)

ON several occasions I have observed a small Lithobiid, which, when disturbed, instead of running swiftly to the edge of a stone and perhaps dropping like the common *L. crassipes*, immediately curls up and rolls off the surface of the stone that has just been raised on to the ground. The small number of antennal joints (up to twenty-eight) as compared with *L. microps* puzzled me, and I therefore submitted examples to Dr. Brölemann, of Pau, who replied that the species was referable to *Lithobius duboscqui*, Brölemann. I have compared my examples very carefully with Brölemann's description, a copy of which he kindly sent me, and they agree in every particular.

As examples of this species will almost certainly be found standing for *L. microps* in British collections, I give the following roughly translated extracts from the original description.

The rounded hind angles of *all* the dorsal scuta place it in the section *Archilithobius*.

LITHOBIUS DUBOSCQUI, Bröl.

Brölemann. 'La Feuille des jeunes Naturalistes,' iii^e sér., xxvi., Nos. 318–319, 1896.

Body very convex, shining, somewhat parallel or more or less narrowed anteriorly, constricted behind the head and broadest about the eighth segment. Yellow, head reddish-brown and the legs light, especially the two posterior pairs, which are yellow-ochre or pale yellow. Length 5·5 to 7 mm., breadth 0·6 to 0·8 mm.

Cephalic plate subcordiform, the posterior angles rounded and the posterior border margined. Antennæ very short, composed of twenty-three to twenty-eight segments, broader than

long, the last equal to about the length of the two preceding together. . . . Ocelli always three in number, disposed in a horizontal line, the posterior ocellus being the smallest and the following the largest. Coxæ of poison-claws longer than broad, with a very distinct median furrow; armed with 2 + 2 small but nevertheless well-formed and sharp teeth. All scuta margined laterally. . . .

The two last pairs of legs are short, very stout, and without furrows or apophyses in the male. Coxæ unarmed.

Armature of fourteenth pair $\frac{0.\ 0.\ 1.\ 0.\ 0}{0.\ 1.\ 2\text{–}1.\ 1\text{–}0.\ 0}$ claw double.

Armature of fifteenth pair $\frac{0.\ 0.\ 1.\ 0.\ 0}{0.\ 1.\ 1.\ 1.\ 0}$ claw double.

Coxal pores small, circular . . . disposition generally as follows:—1. 2. 2. 2 or 2. 2. 3. 2 (exceptionally 2. 3. 3. 3 in one, and in another 1. 2. 2/3. 2.).

External genital organs in the female armed with 2 + 2 very strong and long spines, especially the outer pair, which are sometimes a little curved outwardly. Claw (*unguis*) large, trilobed, with the two inner "teeth" much more developed than the third, which is frequently reduced to a pointed spine.

It is recorded by Brölemann from various parts of France.

I first collected specimens of this species from under stones lying on or slightly embedded in loose rich soil on the Durham banks of the Derwent near Blanchland, April, 1913, and in the same month discovered it in the neighbourhood of Oxford and Manchester.

Dr. Brölemann informs me (*in litt.* April 28th, 1913) that the species must now be known as *Monotarsobius duboscqui* (Bröl.).

[*Reprinted from* 'The Zoologist' *for March, 1914.*]

p. 102.

LITHOBIUS LAPIDICOLA, Meinert, A CENTIPEDE NEW TO THE BRITISH FAUNA.

By Richard S. Bagnall, F.L.S., F.E.S.

Whilst spending a short holiday in North Devon in August of last year (1913), I observed a smallish Lithobiid which occurred in the Ilfracombe district, amongst the larger pebbles and under stones at the foot of the cliffs at Hele Bay, the bathing cove, Ilfracombe, and at Lee Bay, where it was not only found on the shore but on the cliffs also. I could not identify it with any of our known British species and accordingly sent specimens to Dr. Brölemann, who with his customary kindness readily identified them as *Lithobius lapidicola*, Meinert, a South European species.

It comes in the group *Archilithobius*, and according to Latzel near to our species *calcaratus*, though Von Attems* places it in another subdivision, with *pelidnus*, *mutabilis*, &c.

L. lapidicola was described by Meinert in his 'Myriapoda Musæi Hauniensis,' ii., Lithobiini† in 1872, and a description will also be found in Latzel's 'Die Myriopoden der Oster.-Ungar. Monarchie.' ‡

I regret that I have not yet found the opportunity of making a study of the species and therefore cannot, at present, offer any further remarks.

* "Die Myriopoden Steiermarks," Sitz. k. Akad. Wiss. Wien Math.-Naturw. Classe, civ. 1895, pp. 117-238.

† Naturh. Tidskr., viii. 1872, p. 228.

‡ I. Die Chilopoden, 1880, p. 106.

[Reprinted from "The Scottish Naturalist," August 1913.]

THE SCOTTISH SYMPHYLA.

By RICHARD S. BAGNALL, F.L.S., F.E.S. (Hope Department of Zoology, University Museum, Oxford).

FOURTEEN species of Symphyla are now known as British, of which seven occur in Scotland; but as the Scottish records are merely the results of a few short collecting hours mainly in the Clyde and Forth areas, more species may be expected to occur. The forms that have not yet been recognised from north of the borders are *Scutigerella hanseni*, Bagn. (Co. Durham); *Scolopendrella notacantha*, Gervais (Cheshire); *S. isabellæ*, Grassi (Co. Durham); *S. dunelmensis*, Bagn. (Co. Durham); *S. jacksoni*, Bagn.

(Cheshire); *S. horrida*, Bagn. (Co. Durham); and *S. minutissima*, Bagn. (Durham and Yorkshire); whilst two European species, *Scutigerella nivea* (Scopoli) and *Scolopendrella microcolpa*, Muhr, have not as yet been met with in the British Isles. The *S. immaculata* recorded from the Forth area by Mr W. Evans[1] is perhaps a compound species, though all the *immaculata* recorded from Ireland are referable to that species alone. I have, unfortunately, not had the opportunity of examining Mr Evans' old collection.

In the following notes I have used the classification of Hansen; but in a paper I hope to publish shortly, I propose dividing the two groups *Scutigerella* and *Scolopendrella* into certain well-defined genera.

I am much indebted to my friend Mr Evans for the material he is now sending me from the Forth area, and shall always remember the pleasant hours I spent with him collecting these and other little-known creatures in a quarry at the foot of the Pentlands, and on Arthur Seat, Edinburgh, in October of last year (1912).

Scutigerella immaculata (Newp.).

One immature example from the Isle of May, 1910 (W. Evans); several, Rothesay, 1911 (R. S. B.); numerous specimens, Avonbridge, April, and one from Manuel, East Stirling, March 1912 (W. E.). In a quarry at the foot of the Pentlands, and on Arthur Seat, Edinburgh, Oct. 1912 (W. E. and R. S. B.); one, So. Queensferry, Oct. 1912 (R. S. B.). In a quarry, St Fort, near Dundee, Nov. 1912 (R. S. B.).

Scutigerella spinipes, Bagnall.

The first Scottish specimens were taken by Mr Evans at Avonbridge, Stirlingshire, 13th April 1912, and he has since sent me a specimen from the quarry at the foot of the Pentlands above referred to, Oct. 1912. It also occurs in Durham (Wear and Tees Valleys), Northumberland (Tyne Valley), and Cheshire.

Scutigerella biscutata, Bagnall.

This is apparently a less rare and more widely distributed species than *spinipes*.

[1] *Proc. Roy. Phys. Soc.*, xvii., 109 (1907).

On the Clyde, near Bishopton, one example; in a quarry at St Fort, near Dundee, Nov. 1912, one example (R. S. B.). One immature specimen from Avonbridge, April 1912, and a few from the foot of the Pentlands, near Edinburgh, Oct. 1912 (W. E.). Occurs Northumberland (Cheviot and Tyne Valley), Durham (coast, Derwent, Wear and Tees Valleys), and Cheshire. Also in southern Germany (Verhoeff).

Scutigerella caldaria, Hansen.

In greenhouses. I have examined examples taken in the Botanic Gardens, Glasgow.

Scolopendrella subnuda, Hansen.

One example from under a stone, near Brodick, on the Isle of Arran, 1911, and another from So. Queensferry, Oct. 1912 (R. S. B.). Several from the Isle of May, Nov. 1912 (W. E.). In Oct. 1912, Mr Evans and I met with this small form in fair numbers in the now almost historic quarry at the foot of the Pentlands, and on Arthur Seat, near Edinburgh. It is very widely distributed in England.

Scolopendrella vulgaris, Hansen.

A single example taken from under a stone, on the Clyde, near Bishopton; several from a field near Rothesay, in Bute; one from the head of Loch Lomond, near Ardlui; one from St Fort, near Dundee, and one from Colinton, near Edinburgh, Oct. 1912 (R. S. B.). One example, Isle of May, Nov. 1912 (W. E.). In fair numbers from the quarry at the foot of the Pentlands, and on Arthur Seat, near Edinburgh, Oct. 1912 (W. E. and R. S. B.). Apparently widely distributed.

Scolopendrella delicatula, Bagnall.

A single example from the banks of Loch Lomond, near Ardlui, Spring 1912 (R. S. B.). Whilst collecting with me in the quarry at the foot of the Pentlands, near Edinburgh, Mr Evans took a pair of this rare form, and there are a few (mostly young) in the collection we made together on Arthur Seat, Edinburgh, Oct. 1912. It is a distinctly rare species, but evidently rather widely distributed, being also known from Northumberland (Cheviot and Tynedale), Durham (coast, Derwent, and Wear Valleys), Yorkshire (coast), and Cheshire.

References.

1903. HANSEN, H. J.—"The Genera and Species of the Order Symphyla," *Quarterly Journal of Microscopical Science*, vol. xlvii., N.S., pp. 1-101, plates i.-vii.

1910. BAGNALL, R. S.—"A Contribution towards a Knowledge of the British Species of the Order Symphyla," *Trans. Nat. Hist. Soc. of Northumberland, Durham, and Newcastle-upon-Tyne*, N.S., vol. iii., pp. 646-653, pl. xix., figs. 1-10.

1911. BAGNALL, R. S.—"A Synopsis of the British Symphyla, with Descriptions of New Species," *loc. cit.*, N.S., vol. iv., pp. 17-41, pl. i., and text figures (Contains a key to the known European species.)

1912. BAGNALL, R. S.—"Further Records of Some British Symphyla, with Description of a New Species," *loc. cit.*, N.S., vol. iv., pp. 171-176, and text figures.

Vale of Derwent Naturalists' Field Club,
Trans. pp. 94-158, n.s. I, pt. 2, 1913,
(publ. 1914).

V. Derwent Trans., 1913.

48 p.p. 94 to 158.

ZOOLOGY.

p. 94.

3.—THE WOODLICE (Terrestrial Isopoda) OF NORTHUMBERLAND AND DURHAM, WITH KEYS TO THE GENERA AND SPECIES. (Text Figures 1-14).

BY RICHARD S. BAGNALL, F.L.S., F.E.S.,
Fellow of the Royal Physical Society (Edin.), etc.
(Hope Dept. of Zoology, University Museum, Oxford),
V.P. and Sectional President for Arthropoda, etc.

Woodlice, or *Terrestrial Isopod Crustacea,* are to be found almost everywhere. They are continually met with (and ignored) by naturalists searching for other more favoured creatures, and it is only within the last few years that more general interest has been shown in their study.

Comparatively recently, but prior to 1906, a few papers were published by a small band of workers, principally the Rev. Canon A. M. Norman, F.R.S., Prof. G. S. Brady, F.R.S., Dr. R. F. Scharff, and the Rev. T. R. R. Stebbing, F.R.S.

In that year (1906) Messrs. Webb and Sillem's "British Woodlice" appeared, in which all the species—twenty-five—then known, were figured; and being issued at a price within the means of everyone, the publication served its purpose by marking a distinct impetus in the study.

At the same time it must be realised that the possession of this work, together with Prof. G. O. Sars' splendid descriptions and figures of so many of our British Woodlice in his "Crustacea of Norway," vol. ii., is not now sufficient for the study of our species.

Very probably one or other of our present workers will sooner or later produce a more detailed Monograph of the British species, which, though naturally appealing to a more restricted circle, will enable workers to readily

identify their captures, and perhaps deal with allied Continental forms. In the meantime I have attempted in this list of the Northumberland and Durham species to partly fill a want by drawing up tables of families, genera and species, as simply as possible, without sacrificing accuracy, and including, in many instances, a multiplicity of characters, so that each important feature may be separately checked.

The keys to the species are confined to the *Trichoniscidæ* and *Armadillidiidæ*. We have not made such strides in the *Oniscidæ*, and all our British species of *Porcellio*, the only genus containing several, are very closely described and figured by Sars.

As some recent workers appear to be unaware of many of the notes and papers published since 1906 I have appended a bibliography.

Many Woodlice have been regarded as introduced forms, being recorded entirely, or almost entirely from greenhouses and old gardens, where the uniform moisture and rich soil is especially suitable, notably *Trichoniscus roseus*, *T. pygmaeus*, *Trichoniscoides albidus*, *Haplophthalmus danicus*, *H. mengii*, *Metoponorthus pruinosus* and *Cylisticus convexus*. I am able to say, conclusively I think, that all these species are truly endemic, a statement that is strongly borne out by the records hereafter. In this, I think, lies the chief value of the list and the main excuse for its compilation.

Most of the species have been already recorded in Norman and Brady's Crustacea of Northumberland and Durham (1909), in which my notes and records of local Woodlice to that date were recorded.

The letters N1., N2. or/and D. after each name signifies the vice-county North Northumberland (Cheviot), South Northumberland, or/and Durham respectively.

KEY TO THE FAMILIES.

1.—Outer and inner rami of uropods similar in shape (see figs. 1-3) 2

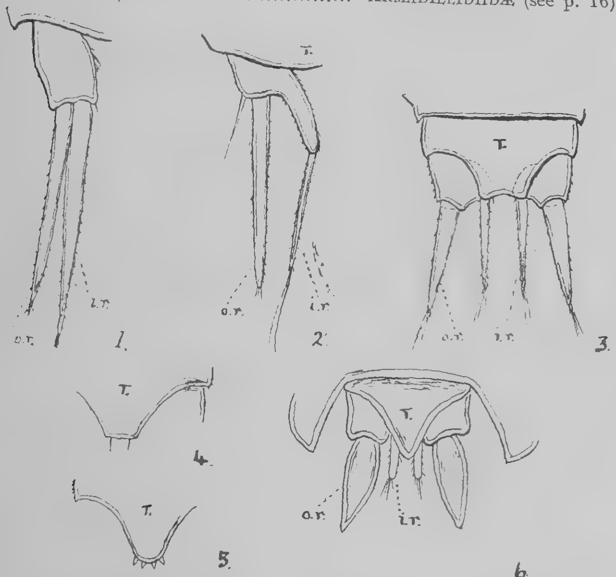
Outer ramus of uropods broader than the inner ramus (see figs. 6 and 14).. 3

2.—Size usually larger. Head without lateral plates. Flagellum of antenna multiarticulate, with 10 or more distinctly defined joints. Uropods entirely exposed (figs. 1-2). External sexual appendages of male double... LIGIIDÆ (see p. 4)

Size smaller, more elongated. Head with small lateral plates. Flagellum of antenna with fewer than 10 joints (which are notso distinctly defined (figs. 7 and 8). Uropods not entirely exposed (figs. 3). External sexual appendages of male simple .... TRICHONISCIDÆ (see p. 4)

3.—Body oval, usually flat, with lateral plates more or less expanded. Uropods long and protruding (fig. 6) ONISCIDÆ (see p. 11)

Body strongly convex, contractile into a ball. Uropods short, not extending beyond the limits of the last segment (figs. 12 and 14) .... ARMADILLIDIIDÆ (see p. 16)



FIGS. 1 and 2.—Left Uropods of (1) *Ligia oceanica* (*L*) and (2) *Ligidum hypnorum* (Cuv.)

FIG. 3.—*Trichoniscus pusillus* Br., end of abdomen, showing Telson and Uropods (rami similar in shape).

FIGS. 3 to 5.—Telson of (3) *T. pusillis* (apex emarginate), (4) *T. pygmæus* (apex truncate), and (5) *T. stebbingi* (apex rounded).

FIG. 6.—*Porcellio dilatatus* Br., end of abdomen, showing Telson and Uropods (rami dissimilar in shape).

T.=Telson. *o.r.* and *i.r.*=outer and inner rami.

FAMILY **LIGIIDÆ**.

1.—Size large (20 to 30 mm.) metasome broad. Uropods elongated, basal part not produced inside, rami subequal (fig. 1) (Habitat littoral) ....Genus LIGIA, Fabricius

2.—Size small (about 9 mm.), metasome small and abruptly contracted. Uropods with basal part produced at the end inside to a conical process carrying the inner ramus. Outer ramus generally larger than the inner (fig. 2). (Habitat, wet moss) Genus LIGIDIUM, Brandt

Genus LIGIA, Fabr.

Ligia oceanica, L. N1., N2., D.

We know only one British species, found commonly on our coasts from Berwick to the mouth of the Tees. It is our largest Woodlouse.

Genus LIGIDIUM, Brandt.

[*Ligidium hypnorum* (Cuvier).

The only British representative of the genus. It has been found in Surrey, Essex and Warwickshire, and as it occurs not uncommonly in Sweden and Denmark we might reasonably expect to find it in the North of England.

FAMILY **TRICHONISCIDÆ**.

1.—Abdomen broad; dorsal face sculptured with more or less distinct longitudinal rib-like or tuberculate ridges. Side plates of body lamellarly expanded, not contiguous. Head with frons triangularly produced; eyes simple. Genus HAPLOPHTHALMUS, Schöbl

Abdomen narrow; dorsal face smooth or irregularly tuberculate. Side plates not lamellarly expanded, contiguous. Head with frons rounded; eyes absent, simple, or each consisting of three visual elements 2

2.—Eyes each composed of three visual elements, rarely simple. Left mandible with 2, right with only 1 penicil behind the cutting part ....Genus TRICHONISCUS, Brandt

Eyes absent or simple. Left mandible with 3, right with 2 penicils behind the cutting part.
Genus TRICHONISCOIDES, G. O. Sars

Genus TRICHONISCUS, Brandt.

1.—Apex of telson truncate or slightly emarginate (see figs. 3 and 4). Species truly indigenous........ 2

Apex of telson more or less arcuate or rounded and furnished with 3 or 4 short broad spines (see fig. 5). Our species found in hothouses........ 6

2.—Body broad, dorsal face but slightly convex, rather coarsely tuberculate. Eyes simple. Colour white to a clear minium-rose........T. ROSEUS (Koch)

Body oblong-ovate, dorsal face more convex, smooth or minutely tuberculate. Eyes composed of 3 visual elements 3

3.—Dorsal face smooth, shining, apex of telson slightly emarginate (see fig. 3) Length about 4 mm........ 4

Dorsal face practically smooth, more or less minutely tuberculate. Apex of telson truncate (see fig. 4). Length 2 mm. and 8 mm. 5

4.—Peduncle of antennæ spinose, flagellum composed of 4 joints (see fig. 7) Colour dark reddish brown marbled with white
T. PUSILLUS, Brandt

And colour a beautiful violet........VAR. VIOLACEUS, Schöbl

Peduncle not spined, flagellum composed of 5-7 joints (fig. 8). Otherwise as in *pusillus*...T. INTERMEDIUS, Bagn. (prov.)

5.—Size larger, (8 mm.) and more ovate. More finely tuberculate. Peduncle of antennæ without spines, flagellum composed of 5-7 joints. Colour claret-brown marbled with lighter patches
T. VIVIDUS (Koch)*

Size smaller (2 mm.) and more linear; less finely tuberculate. Peduncle of antennae spinose, flagellum 3-jointed. Colour whitish, with a few light reddish pigmentary ramifications.
T. PYGMÆUS, G. O. Sars

* Pack-Beresford and Foster tabulate this species as having simple eyes like *roseus*. I have not studied it.

6.—Eyes composed of 3 visual elements; form oblong-ovate. Colour darker. Length about 3.5 mm. 7

Eyes composed of 3 visual elements or simple; form linear. Colour white. Length less than or about 3.0 mm........... 8

7.—Dorsal surface tuberculate. Flagellum of antenna 4-7 jointed. Last pair of legs with the last joint in both sexes densely ciliated on the outside. Telson with apex broadly and evenly rounded (see fig. 5)..................T. STEBBINGI, Patience

Dorsal surface spinulose. Flagellum of antenna 3-jointed. Last pair of legs in both sexes with the last joint armed with 3 or 4 short but fairly prominent spines. Telson obtusely rounded ....T. SPINOSUS, Patience

8.—Eyes simple. Body 3.5 times as long as broad. Side plates of mesosome not toothed .... T. LINEARIS, Patience*

Eyes composed of 3 visual segments. Body nearly 5-0 times as long as broad. Side plates each armed with 5 stout downwardly curved teeth .... TRICHONISCUS sp., Bagnall†

Trichoniscus roseus. Koch. N1., N2., D.

This beautiful Woodlouse is nearly always regarded as a garden or greenhouse species, being common in old gardens and greenhouses throughout the country. In the following records, however, I am able to give habitats which go to show that we can claim *T. roseus* as a truly endemic species. The white variety is not uncommon.

NORTHUMBERLAND.—In hothouses and gardens, Newcastle-upon-Tyne and Alnwick. In numbers amongst shale on wet clayey sea banks at Seaton Sluice and near the Abbey, Tynemouth, Autumn, 1911. On sea banks, Whitley Bay, March, 1914.

DURHAM.—In gardens at Winlaton, Gibside, Penshaw and Sunderland. In numbers under stones lying on a clayey soil on the banks of a burn running into the Wear near Fatfield (W. Hall and R.S.B.), and with *Cylisticus* under stones on the river banks near Washington.

* Described from specimens taken by the writer in Kew Gardens.

† From a hothouse in the Glasnevin Botanic Gardens.

Trichoniscus pusillus (Brandt). N1., N2., D.

I have found this common species, which occurs chiefly in damp situations amongst dead leaves, moss, etc., wherever I have collected, though it is always rare on our moorlands.

T. pusillus var. *violaceus*, Schöbl. N1., N2., D.

See Bagnall in Norman & Brady.

A beautiful form which I am confident is referable to the *Trichoniscus violaceus*, Schöbl, described from waterfalls in Bohemia. It was first met with (and recognised) by Mr. Gill and myself in the moss of a waterfall and among refuse at the foot, over which water continually drops, at Gibside.

NORTHUMBERLAND.—In damp situation by side of the stream which runs into Seaton Sluice (A. M. Norman). On the sea banks by trickling water at Seaton Sluice and Tynemouth. Near Wooler, May, 1913 (H. S. Wallace and R.S.B.). Gosforth Lake (H. S. Wallace).

DURHAM.—Gibside, in moss of waterfalls (E. L. Gill and R.S.B.). Under stones on the sea banks, Fulwell and Ryhope (G. S. Brady); at Ryhope, Blackhall Rocks, and Hart. In well at Winlaton and from under stones in a small stream at Scaur banks, Winlaton Mill. On the banks of the Derwent at the Ladies' Steps near Swalwell (H. S. Wallace and R.S.B.), and on the banks of a stream running into the Wear near Fatfield (W. Hall). In a dene near Fence Houses.

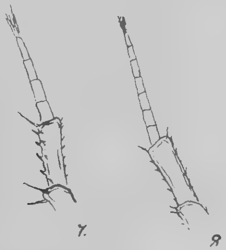


FIG. 7.—*Trichoniscus pusillus* Brandt.
FIG. 8.—*Trichoniscus intermedius* (prov.) Bagn. Last joint of peduncle and the flagellum of antenna.

Trichoniscus intermedius (prov.), Bagnall. N2.

See Bagnall in Norman & Brady.

Telson and general appearance as in the ubiquitous *T. pusillus* except the antennæ which are like those in *T.*

vividus (Koch) ; the flagellum 5-7 jointed, and the peduncle very smooth, without the spines which characterize the peduncle of *T. pusillus* (see figs. 7 and 8). I have not yet seen further examples of this form.

NORTHUMBERLAND.—Two examples taken amongst herbage, Butcher Hill Farm, near Matfen, September, 1906.

Trichoniscus pygmæus (G. O. Sars). N1., N2., D.

This is another truly endemic species and one which is probably widely distributed throughout the British Isles. It was first discovered in this country, almost simultaneously, by Mr. Patience and myself in the summer of 1906, in the Clyde area and North of England respectively.

NORTHUMBERLAND.—In gardens and cool conservatories, Newcastle, Wylam-on-Tyne, Matfen, Alnwick and Blanchland. Sea banks at Hartley and Tynemouth. By the roadside near Etal Village and at Skirlnaked near Wooler, May, 1913. Bywell (H. S. Wallace).

DURHAM.—Gardens at Winlaton, Gibside, Fellside, Ravensworth, Penshaw, South Hylton, Sunderland and St. John's Chapel. In quarries by the banks of rivers or streams and in woods and fields, Gibside, Winlaton, Swalwell (on moss), Hylton, Penshaw, Lambton, Leamside, Barnard Castle, Piercebridge and Eggleston-in-Teesdale. On the railway banks near Bradbury.

Trichoniscus stebbingi (Patience). N1., N2., D.

In hothouses, at roots of potted plants.

NORTHUMBERLAND.—Wylam, August, 1907 ; Alnwick, September, 1907 ; Newcastle, 1907 ; and in numbers at the roots of orchids, February, 1913.

DURHAM.—Winlaton Mill, 1909.

Genus TRICHONISCOIDES, G. O. Sars.

1.—Form slightly more ovate ; colour of body usually dull reddish-brown or claret, with underside noticably whitish. Flagellum of antennæ composed of 3 joints ....T. ALBIDUS, B.L.

2.—Form more linear ; colour golden yellow. Flagellum of antennæ composed of four joints..............T. SARSI, Patience*

* Very striking and important differences in the structure of the 1st and 2nd pairs of pleopoda and the 7th peræopod in the male are fully tabulated and figured in Patience's valuable paper on these two species.

Trichoniscoides albidus (Budde-Lund). N.D.

Another truly endemic form, sometimes found in numbers on the clayey sea-cliffs or on our river banks.

Mr. Patience has shown that the *T. albidus* of G. O. Sars is a different species, and names it *T. sarsi*. I recently (1912) found *T. sarsi* (Patience) on the sea-banks near Whitby, Yorks, and it may be expected to occur in our Counties. It was previously only known from the neighbourhood of Christiania, Norway.

I have only seen one white example of *T. albidus*.

NORTHUMBERLAND.—A few examples with *T. roseus* and *T. pygmæus* in a cool conservatory at Alnwick, September, 1907. On sea banks, Whitley Bay, March, 1914.

DURHAM.—Carley Hill Quarry near Sunderland, 1904 (G. S. Brady). In a garden, Winlaton, 1907. On the sea banks between Sunderland and Hartlepool (Ryhope, Blackhall Rocks and Hart), sometimes in fair numbers, usually found under quite small stones embedded in the rich clayey soil where moist. In numbers on the banks of the Wear between Sunderland and Lambton; at Hylton, Coxgreen, Penshaw, and Lambton; on the Derwent near the Ladies' Steps, Swalwell (soil sandy) May, 1913, and one specimen on the banks of a stream at Bradbury near Durham.

Genus TRICHORINA (B.-L.)

Trichorina tomentosa (B.L.) N2., D.

On December 2nd, 1907, Mr. Donisthorpe and I found several specimens of a small white Woodlouse in propagating houses, Kew, which were chiefly, though not entirely found in the neighbourhood of an introduced West Indian ant, *Wasmannia auropunctata*, (Roger). I later found examples in other greenhouses and Mr. Patience took it in the Glasgow Botanic Gardens. We decided that it was referable to *Bathytropa thermophila* (Dollfus), but as his figures were not good I merely recorded it as *Bathytropa* sp. (1909-3). More recently it has been taken by Mr. Foster and others in Belfast Botanic Gardens and brough forward by Mr. Foster [1911-2] as this species. His specimens were identified by Prof. Budde-Lund as *Trichorina* (*Alloniscus*) *tomentosa*

(B.-L.) a Venezeulan species, of which Dollfus' name *Bathytropa thermophila* is a synonym.

NORTHUMBERLAND.—Several in a propagating house in Leazes Park, Newcastle-on-Tyne, 1910.

DURHAM.—One example from a hothouse at Winlaton Mill, 1911.

Genus HAPLOPHTHALMUS, Schobl.

1.—Size usually smaller (♀ 3 mm.). Mesosome with very distinctly sculptured ribs ; abdomen with a pair of prominences, one on each side of mid-line of the 3rd segment. (Antennulæ with 4 sensory filaments) .... H. MENGII, Zaddach

2.—Size usually larger (♀ 4 mm.) Mesosome with tubercles arrangedin longitudinal rows ; abdomen without prominences on 3rd segments. (Antennulæ with 6 sensory filaments.) .... H. DANICUS, Budde-Lund

Haplophthalmus mengii (Zaddach). N1., N2., D.

Though generally regarded as a rare species I have met with this sluggish Woodlouse in many widely separated localities, chiefly in the open country, from Dundee in the north to Oxford in the south. The following data leaves no doubt as to the species being endemic. Only three localities are given in Webb and Sillem's "British Woodlice."

NORTHUMBERLAND.—In gardens and cool greenhouses, at Newcastle (October, 1906 onwards). A few examples at Skirlnaked and Whitsunbank Hill near Wooler, May, 1912 and May, 1913. Ninebanks near Whitfield, February, 1913 (J. E. Hull).

DURHAM.—Fulwell Quarry near Sunderland (G. S. Brady). Under stones in gardens at Winlaton, Fellside, Penshaw, Gibside, Hylton, Sunderland and Hart. In quarries, Penshaw and Hylton. On the sea banks at Ryhope and Hart frequent ; also near Greatham Salt Marshes (April, 1910, and twice in 1913). Derwent banks at Winlaton Mill and near Swalwell. Wear banks (sometimes very plentiful) at Cox Green, Fatfield, Lambton, Leamside, and Durham, and in a dene near Fencehouses. Plentiful on the Durham banks of the Tees near Piercebridge and Barnard Castle, and in the neighbourhood of Bradbury.

Haplophthalmus danicus (Budde-Lund). N2., D.

Although mostly recorded from gardens there is no doubt that this, too, is an endemic species, though I have not met

with it so often as *H. mengii.* I have recently taken specimens in the open country near Oxford.

NORTHUMBERLAND.—A mature male and young in garden Wylam-on-Tyne, August, and in numbers in gardens and cool greenhouses Leazes Park, Newcastle, August, 1907.

DURHAM.—Humbledon Hill near Sunderland (G. S. Brady). Several examples with *Trichoniscoides albidus* on the Wear banks near Penshaw (soil somewhat sandy), Autumn, 1911.

FAMILY **ONISCIDÆ.**

1.—Eyes absent. Flagellum composed of a single broad joint. Myrmecophilous................................ Genus PLATYARTHRUS

Eyes compound. Flagellum composed of 2 or 3 joints 2

2.—Flagellum 3 jointed 3

Flagellum 2-jointed 4

3.—Abdomen broad. Head with side lobes............Genus ONISCUS

Abdomen narrow. Head without side lobes ......Genus PHILOSCIA

4.—Body strongly convex, able to roll up into a ball (as in *Armadillidium* but with uropods protruding).........Genus CYLISTICUS

Body more or less depressed, unable to roll up into a ball... 5

5.—Abdomen broad. Head with frontal lobe projecting. Genus PORCELLIO

Abdomen narrow. Lobes of head scarcely developed. Genus METOPONORTHUS

Platyarthrus hoffmannseggii (Brandt). D.

An interesting little inhabitant of ants' nests, which is very rare in Scotland and also rare in the North of England.

DURHAM.—Carley Hill Quarry near Sunderland (G. S. Brady). Two examples with *Myrmica rubra* at Chopwell, 1906, and several with the same ant at Greatham, near Hartlepool, June, 1908.

Oniscus asellus, L. N1., N2., D.

Common everywhere.

Philoscia muscorum (Scopoli). N1., N2., D.

Generally common under stones in hedgerows, and amongst dry grass, vegetable matter. I have taken it throughout the area. All our northern examples are darker than specimens from the South of England. I know three well-marked and striking colour varieties which I think might be designated as follows :—

P. muscorum var. *obscura* nov. N1., N2., D.

Robust, very dark and almost unicolorous. Not uncommon under stones in gardens and on cultivated land; found throughout Northumberland and Durham.

P. muscorum var. *flava* nov. D.

Also robust. Bright yellow, markings dark. In damp moss of waterfalls, two examples from Gibside, Co. Durham, and one from Saltburn, Yorkshire. A less robust, light lemon-yellow variety occurs in the South.

[*P. muscorum* var. *rosea* nov.

Moderately robust. Of a beautiful minium or deep rose-pink colour, even more strikingly coloured than *Trichoniscus roseus*.

South of England.—I have seen examples from Lundy Island and the Isle of Wight (H. St. G. K., Donisthorpe), and Sidmouth, South Devon (A. Randell Jackson). Mr. Cummings records it from Lundy Island and North Devon.

Philoscia patiencei, Bagnall. D.

Undoubtedly introduced with plants. Described from numerous specimens taken by the author in a propagating house, Kew Gardens, and since recorded by Dr. A. Randell Jackson from Chester. It is a small species which when alive bears a very strong resemblance to the common *Trichoniscus pusillus*, both in its general appearance and movements.

Durham.—Immature examples taken in garden at Winlaton October, 1906, and February, 1907.

Porcellio scaber (Latreille). N1., N2., D.

Common everywhere and more plentiful than the ubiquitous *Oniscus asellus*. The following extract is taken from the "Crustacea of Northumberland and Durham." "Including varieties *marmorata* and *marginata* of Brandt and Ratzeburg, the latter variety very rare. Also a large form, bright red in colour, which might be called var. *rufa*. A single specimen Winlaton, and three examples sent to me by Mr. Donisthorpe, taken in the nest of the red ant *Formica sanguinea*. A small variety is found in colonies in the busiest parts of the nests of the wood ant *Formica rufa* at Corbridge-on-Tyne; it is much smaller than the type, the dorsal surface not so scabrous, cephalic lobe less pointed, and distal joint of the flagellum longer in relation to basal joint; but as the sexual characters, etc., on dissection, entirely agree with *P. scaber*, it would be better to regard it as a form of that species, most likely produced after several generations with the ants; it might bear the distinguishing name var. *Darwiniana*. On two occasions I have found colonies almost identical with the last living under stones in rock-pools of salt water and entirely submerged; and when disturbed they merely ran along the bed of the pool to seek shelter under another stone or piece of weed. (Bagnall)."

The following are the localities for the varieties indicated above :—

P. scaber var. *marmorata* (Br. and Ratz.) N1., N2., D.

Not uncommon with the type.

P. scaber var. *marginata* (Br. and Ratz.) N1., N2., D.

Rarer, but has occurred in the three vice-counties.

P. scaber var. *rufa* (Bagnall), in Norman and Brady [1909], var. *rufescens* (Collinge) [1913], D.

One specimen in a field near Winlaton.

P. scaber var. *darwiniana* (Bagnall), in Norman and Brady [1909]. N2., D.

Common in the nests of the wood ant *Formica rufa* at Corbridge and Stocksfield-on-Tyne, and in Chopwell Woods.

Porcellio pictus (Brandt and Ratzeburg). N1., N2., D.

A pretty species, readily distinguished in the field by its black head.

NORTHUMBERLAND.—Several in rubbish heap behind Hancock Museum, Newcastle, August, 1907. Common on an old wall by road side, Corbridge-on-Tyne, and a few in the neighbourhood of Wooler, May, 1912 and May 1913. Crawling on an old wall, Shildon, near Blanchland, March, 1913.

DURHAM.—In gardens and cellars, Winlaton, 1906 onwards. Common under stones and under bark of logs laid for firewood, Egglestone-in-Teesdale, April, 1907. In the neighbourhood of Barlow and Winlaton, and in Gibside. Several in an old starling's nest, Penshaw, July, 1911.

Porcellio dilatatus (Brandt). N1., N2., D.

In old gardens and cool greenhouses, usually in numbers.

NORTHUMBERLAND.—Newcastle, August, 1907 onwards ; Alnwick, September, 1907.

DURHAM.—Winlaton, May, 1907, in very large numbers ; Sunderland Hylton, Lambton, Ravensworth (June, 1907), etc.

Porcellio rathkei (Brandt). N1., N2., D.

A distinctly rare species, but apparently wide spread in England. Not yet recorded from Scotland.

NORTHUMBERLAND.—Stocksfield (G. S. Brady), two examples from near Alwinton, June, 1911, and a young specimen from Ninebanks sent me by the Rev. J. E. Hull, February, 1913.

DURHAM.—Humbledon Hill, near Sunderland, and near Winlaton Mill (G. S. Brady). One example from a meadow near Rowlands Gill, May, 1907.

Porcellio lævis (Latreille). N2.

This is a distinct but rare species of which I am only able to bring forward one local record. Not yet recorded from Scotland.

NORTHUMBERLAND.—One adult and three young in heap of garden refuse, etc., behind the Hancock Museum, Newcastle-on-Tyne, January, 1907.

Genus NAGARUS (B.-L.)

Nagurus cristatus (B.-L.) N2.

Introduced with plants. Two other allied species *Angara lenta* (B.-L.) a Mediterranean species, and *Angara nana* (B.-L.) known from Madagascar, have been recorded from British greenhouse.

NORTHUMBERLAND.—One example in one of Mr. Cookson's greenhouses, August 28th, 1907. Identified by the late Dr. Budde-Lund.

Metoponorthus pruinosus (Brandt). N1., N2., D.

A beautiful creature, but the pruinose bloom is lost at once when it is put into spirit. It is often common in greenhouses with *Porcellio dilatatus*, but is by no means so common in the open country.

NORTHUMBERLAND.—Greenhouses and gardens: Wylam-on-Tyne, August, 1906, Newcastle, swarming with *P. scaber* in garden rubbish, October, 1906, and Alnwick, common, September, 1907. Open country: a few examples in neighbourhood of Wooler, May, 1912, and at Etal Village, near Wooler (H. S. Wallace and R.S.B.), May, 1913.

DURHAM.—Garden, Burnmoor Rectory (Canon A. M. Norman, F.R.S.) One specimen in a quarry near Winlaton, April, 1906, where it also occurs in a cellar and swarming in greenhouses, June, 1907; in numbers under stones on road side from Greatham station to Saltmarsh, June, 1906 and March, 1913; Axwell Park in the open, September, 1906. Gibside Woods and Lambton in the open country, and in hothouses, Sunderland.

Two other species of this genus are known, *M. cingendus* (Kinahan) from Ireland and South Devon, and *M. melanurus* (B.-L.) a littoral species recently recorded by Dr. Scharff [1910] from Ireland.

Cylisticus convexus (De Geer). N1., N2., D.

Though not common, this Woodlouse, which like the true pill-woodlice *Armadillidium*, is able to roll up into a ball,

is evidently widely distributed. I first found it locally at Whitley Bay in June, 1907, and have since observed it in several localities.

NORTHUMBERLAND.—Whitley Bay, one example, June 2nd, 1907; Alnwick, common in conservatory, ix. 1907; Wooler, May, 1912 and again in 1913. Hexham (H. S. Wallace) June, 1913.

DURHAM.—Occasionally in a manure heap in Axwell Park from November, 1908 onwards; in garden at Winlaton, in cool conservatory at Hylton, near Sunderland, and in some numbers with *Trichoniscus roseus* under stones on the banks of the river near Washington. In a field near Fatfield.

FAMILY **ARMADILLIDIIDÆ.**

1.—Eyes compound. First body segment with the posterior angle of lateral plate simple, not nicked or divided (see figs. 10 and 11). Uropods extending to apex of telson at most.
Genus ARMADILLIDIUM, Brandt

2.—Eyes simple. First body segment with the posterior angle of lateral plate divided behind (see fig. 9). Uropods extending slightly behind apex of telson though not beyond the epimeral plates of penultimate abdominal segment.
Genus ELUMA, Budde-Lund

Genus ARMADILLIDIUM, Brandt.

1.—Colour white, sometimes shaded with grey; dorsal surface closely granular and sparsely set with minute hairs. Outer ramus armed with a distinct tooth at the outer apicalcorner. Distal joint of the flagellum 3 times as long as the basal. Length 6.0 mm. .... A. ALBUM, Dollfus

Colour more or less dark, with lighter variegations. Surface smooth and shining. Outer ramus without tooth. Length 5mm. or 12 to 17 mm... 2

2.—Size smaller (5 mm.) Side plates of first body segment abruptly truncated at posterior angle (see fig. 11). Distal joint of flagellum 3 times as long as the basal. Colour brown with yellow and lighter markings.
A. PULCHELLUM, Zencker

Size larger (up to 17 mm.). Side plates of first body segment with the posterior angles more or less acute (see fig. 10). Joints of flagellum practically subequal. Ground colour usually lighter or darker grey, marked with yellowish and lighter markings 3

3.—Antennæ shorter* (about 0.25 the length of the body) with the distal joint of flagellum slightly shorter than the basal. Telson much shorter than broad; uropods with the outer ramus much shorter than the basal part and broader than long. Length 12 to 15 mm. ....A. VULGARE, Lat.

Antennæ longer (about 0.35 to 0.4 the length of the body) with the joints of flagellum practically subequal. Telson longer than broad (see fig. 14); uropods with the outer ramus at least as long as broad and longer than the basal part. Body finely and closely punctured, and on sides, at least, more or less distinctly tuberculate 4

4.—Size smaller (15 mm.) more convex. Tubercles less distinct. Head with narrow, strongly projecting frontal lobe. Telson much longer than wide, tapering with sides incurved and apex obtusely rounded; uropods with outer ramus much longer than basal part and much longer than broad (see fig. 14) .... A. NASATUM, Budde-Lund

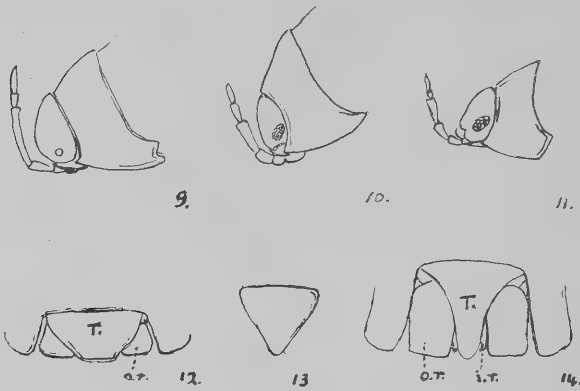
Size larger (17 mm.), broad and less convex. Tubercles more distinct. Head with broad and short frontal lobe. Telson slightly longer than wide; sides scarcely incurved and apex truncate; uropods with the outer ramus only slightly longer than the basal part and as long as broad (as in fig. 12).
A. DEPRESSUM, Brandt

NOTE.—Two other European species may reasonably be expected to occur in Great Britain; they are:—

Armadillidium opacum (Koch). Like *A. vulgare* but only 9 mm in length; light grey in colour, irregularly marked with darker patches. Telson very broad and bluntly rounded apically, and the distal joint of flagellum nearly twice as long as the basal.

*Figure in Webb & Sillem's "British Woodlice," is, in this respect, misleading.

**Armadillidium pictum* (Brandt). Size 8 mm. Most like *A. pulchellum* in colour and markings, but with hind angles of side plates of first body segment acute. Differs from *vulgare, opacum* and *pulchellum* in the shape of its telson which is triangular in form and as fong as broad (fig. 13).



FIGS. 9, 10 and 11.—Head and first thoracic plate (viewed laterally) of (9) *Eluma purpurascens* B.-L. (single eye, nicked hind angle); (10) *Armadillidium vulgare* (Latr.) (pointed hind angle).; and *A. pulchellum* Zencker (truncate hind angle).

FIGS. 12 and 14.—End of abdomen, showing Telson and outer rami of Uropods of *Aramadillidium pulchellum* (Zenk.) and *A. nasatum* B.-L. respectively.

FIG. 13.—Telson of *A. pictum* Brandt.

Armadillidium vulgare (Latreille). N1., N2., D.

Though moderately common and widely spread I have never known this species to occur in any numbers in the Northumberland and Durham area.

NORTHUMBERLAND.—Coast; Tyne and North Tyne, Alnwick, Wooler, Blanchland and Slaley, etc.

DURHAM.—Winlaton, Gibside, Chopwell, Edmundbyers, Hylton, Penshaw, Lambton, Weardale, Roker, Ryhope, Blackhall Rocks, Hart, and Greatham. Teesdale.

*Mr. Standen has recorded this species from Westmorland—see "Lancashire Naturalist," July, 1913.

Armadillidium pulchellum (Brandt). N1., N2., D.

This small species is generally found in dry situations, and often in the proximity of ants. Our first local specimens were taken by Prof. G. S. Brady, F.R.S.

NORTHUMBERLAND.—Near Stocksfield, Devil's Water, 1906 (G. S. Brady). In colonies of the black ant (*Formica fusca*) at Hedley, near Stocksfield, and in a wood near Ebchester, October 5th, 1907, several examples. Under stones by a road side near Alwinton, June, 1911, rare. The Rev. J. E. Hull has recently sent me examples taken on the Fell near Ninebanks at about 1,500 feet, February, 1913, and the following month I found it at Shildon, near Blanchland.

DURHAM.—A few adult and numerous young specimens occurred regularly under a small stone lying on the slopes of a path side near Winlaton, from August, 1906, until the following Spring. Gibside, April, 1913.

Armadillidium nasatum (Budde-Lund). N1., N2., D.

In Ireland, Scotland, and the greater part of England this species more or less commonly in hothouses and conservatories, but in the South of England it is also to be found in the open country living under natural conditions. *A. nasatum* is recorded from France, Spain, and Italy, and I have taken hothouse examples in Norway, Denmark and Belgium.

NORTHUMBERLAND.—Wylam, Alnwick and Newcastle-upon-Tyne.
DURHAM.—Sunderland, Penshaw, Hylton and Winlaton.

Genus ELUMA (Budde-Lund).

[*Eluma purpurascens* (B.-L.)

This species was only recently recorded from the British Isles from the neighbourhood of Dublin, where it was met with in numbers by Mr. D. R. Pack-Berefsord and the writer.

LIST OF PAPERS ON BRITISH WOODLICE.

PUBLISHED FROM 1906 TO DATE.

BAGNALL, R. S., 1906. *Trichoniscus pygmaeus*, G. O. Sars, a Woodlouse new to the British Fauna. Ann. and Mag. Nat. Hist., ser. 7, xviii., p. 474.

BAGNALL, R. S., 1907. On some Terrestrial Isopod Crustacea new to the fauna of Belgium. Ann. Soc. Roy. Zool. et Malacol. Belgique, xlii, pp. 263-266.

BAGNALL, R. S., 1908-1. On the occurrence in Belgium of a recently described Terrestrial Isopod, *Trichoniscus stebbingi*, Patience. Op. cit. xliii., 127-129.

BAGNALL, R. S., 1908-2. On *Armadillidium album*, Dollfus, a rare Woodlouse new to the fauna of Great Britain. Zoologist, pp. 152-154.

BAGNALL, R. S., 1908-3. On *Philoscia patiencei*, sp. n., a new Terres trial Isopod. Ann. and Mag. Nat. Hist., ser. 8, i., pp. 428-431 ; pl. xviii.

BAGNALL, R. S., 1908-4. Records of some Irish Woodlice with note on *Eluma purpurascens*. Irish Nat., xviii., pp. 259-260.

BAGNALL, R. S., 1909-1. On some Terrestrial Isopods from the Glasnevin Botanic Gardens, Dublin. Op. cit., pp. 42-44.

BAGNALL, R. S., 1909-2. *Armadillidium nasatum* and *A. pictum*. Op. cit., pp. 54-55.

BAGNALL, R. S., 1909-3. Terrestrial Isopod Crustacea in " The Wild Fauna of the Royal Botanic Gardens, Kew," ix. ; Bull. Miscel. Information, pp. 244-246.*

BAGNALL, R. S., 1910. Records of some Scandinavian Woodlice. Zoologist, pp. 223-225.

BAGNALL, R. S., 1912. Note on the occurrence in Yorkshire of *Trichoniscoides sarsi*, Patience, a Woodlouse new to the British fauna. Op. cit., pp. 193-194.

BAGNALL, R. S., 1913. Records of two rare Woodlice from the Forth area. Scottish Nat., pp. 39-40.

BELFAST NATURLISTS' FIELD CLUB (Notes on Woodlice observed). Proceedings for 1908-9, 1909-10, 1910-11, 1911-12, 1912-13, ser. ii., vol. vi.

BERESFORD, D. R. PACK, 1906. Woodlice in County Carlow. Irish Nat., xv., p. 142.

BERESFORD, D. R. PACK, 1907-1. Woodlice in County Carlow. Op. cit., xvi., p. 250.

BERESFORD, D. R. PACK, 1907-2. *Cylisticus convexus* in County Down Op. cit., xvi., p. 351.

BERESFORD, D. R. PACK, 1907-3. See BUCHANAN-WOOLASTON.

BERESFORD, D. R. PACK, 1908-1. Some new Irish Woodlice. Op. cit., xvii., p. 206.

BERESFORD, D. R. PACK, 1908-2. *Eluma purpurascens*. A Woodlouse new to the British Isles. Op. cit., xvii., pp. 255-258., pl. 10.

BERESFORD, D. R. PACK and FOSTER, N. H., 1908. On the Distribution of Woodlice in Ireland as known at the end of 1908. Op. cit., xviii., pp. 92-93.

* For additional records see *ibid*, xii., 1911, p. 365.

BERESFORD, D. R. PACK and FOSTER, N. H., 1911. The Woodlice of Ireland, their distribution and classification. Proc. R. I. Acad., xxix., pp. 165-190., pl. viii.

BERESFORD, D. R. PACK and FOSTER, N. H., 1913. Additions to the distributional records of Woodlice in Ireland till the end of 1912 Irish Nat., xxii., pp. 45-48.

BRADY, G. S., F.R.S., 1909, see Norman.

BUCHANAN-WOLLASTON, H. J. and BERESFORD, D. R. PACK, 1907. Contributions to the Natural History of Lambay, County Dublin: Isopoda. Irish Nat., xvi., p. 59.

COLLINGE, W. E., 1913. The Terrestrial Isopoda of the Midland Plateau. Journ. Econ. Biol., viii., pp. 1-21, figs.

CUMMINGS, B. F., 1907. Notes on Terrestrial Isopods from North Devon. Zoologist (4th ser.), xi., pp. 465-470.

CUMMINGS, B. F., 1909-1. Notes on the Fauna of Lundy Island. Op. cit. (4th ser), xiii., pp. 441-446.

CUMMINGS, B. F., 1909-2. The Land Isopoda of Lundy Island. Ann. and Mag. Nat. Hist., ser. 8, iv., pp. 319-320.

FOSTER, N. H., 1907. Irish Field Club Union Report: Isopoda. Irish Nat., xvi., p. 302.

FOSTER, N. H., 1908-1. *Trichoniscus pygmæus*, Sars, a Woodlouse new to Ireland. Op. cit. xvii., p. 56.

FOSTER, N. H., 1908-2. *Armadillidium pictum*, Brandt, an addition to the Britannic fauna. Op. cit., xvii., pp. 135-6., pl. 6.

FOSTER, N. H., 1909-1. *Armadillidium pictum*—a correction. Op. cit., xviii., p. 54.

FOSTER, N. H., 1909-2. see BERESFORD.

FOSTER, N. H., 1910. Irish Field Club Union; Report, Isopoda Terrestria. Irish Nat., xix., p. 187.

FOSTER, N. H., 1911-1. *Trichoniscus stebbingi* in Down and Antrim. Op. cit., xx., p. 95.

FOSTER, N. H., 1911-2. On two exotic species of Woodlice found in Ireland. Op. cit., xx., pp. 154-156.

FOSTER, N. H., 1911-3. *Nagara nana*—a correction. Op. cit., xx. p. 184.

FOSTER, N. H., 1911-4. See BERESFORD.

FOSTER, N. H., 1912. Clare Island Survey, Land and Fresh-water Isopoda. Proc. R. I. Acad., xxxi., pp. 42-44.

FOSTER, N. H., 1913. See BERESFORD.

JACKSON, A. RANDELL, 1910. On some Arthropods observed in 1909. Lancashire Nat., pp. 17-51.

NORMAN, A. M., F.R.S., and BRADY, G. S., F.R.S., 1909. The Crustacea of Northumberland and Durham. Trans. Nat. Hist. Soc. Northd., D'ham and Newcastle-upon-Tyne, n.s. iii., pp. 252-417, plates viii.-ix. (A)

PATIENCE, ALEX., 1907-1. On a new British Terrestrial Isopod *Trichoniscus spinosus*, sp. n. Ann. Scottish Nat. Hist., pp. 85-88, pl. iii.

PATIENCE, ALEX., 1907-2. On a new British Terrestrial Isopod, *Trichoniscus Stebbingi*, sp. n. Journ. Linn. Soc., Zool., xxx., pp. 42-44, pl. 7.

PATIENCE, ALEX., 1908-1*. On some Terrestrial Isopods new to the Clyde Faunal area, and some notes on the distribution of the rarer species. Trans. Nat. Hist. Soc. of Glasgow, n.s., viii., 1905-06.

PATIENCE, ALEX., 1908-2. On a new British Isopod, *Trichoniscus linearis*, sp. n. Ann. and Mag. Nat. Hist., ser. 8., i., pp. 280-282, pl. xi.

PATIENCE, ALEX., 1908-3. On *Trichoniscoides albidus*, Budde-Lund, and *T. sarsi*, Patience (nom. nov.) Op. cit., ser. 8., ii., pp. 84-88, pl. vi.

POPPLE, EDWARD, 1213. Hertfordshire Oniscoida. Trans. Herts. Nat. Hist. Soc., xv., pt. 1, pp. 29-32.

SCHARFF, R. F., 1907. European Animals.

SCHARFF, R. F., 1908. In Dublin Microscopical Proceedings. Irish Nat., xvii., p. 124.

SCHARFF, R. F., 1910. *Metoponorthus melanurus*, a species of Woodlouse new to Ireland. Op. cit., xix., p. 92.

SCOURFIELD, D. J., 1906. Crustacea in "The Wild Fauna and Flora of the Royal Botanic Gardens, Kew." Bull. Miscel. Information, additional series v.

STANDEN, R., 1909. On the distribution and habits of *Platyarthrus hoffmannseggii*. Lancashire Nat., ii., pp. 239-242, pl.

STANDEN, R., 1913. *Armadillidium pictum*, Brandt, in Westmorland, a species new to the British Isles. Op. cit., vi., pp. 121-122.

STELFOX, A. W., 1912. Woodlice from the Great Blasket, South Kerry. Irish Nat., xxi., p. 206.

STEPHENS, N. E., 1911. Some Terrestria Isopoda found in Counties Dublin and Wicklow during 1911. Irish Nat., pp. 195-196.

TATTERSALL, W. M., 1908. Handbook to the City of Dublin and Surrounding District (Brit. Assoc. Guide) Isopoda, pp. 182-184, figs. a, b, c, d.

UNWIN, E. E., 1908. The Respiration of Land Isopods. British Assoc. Report, p. 236.

* Although read in June of 1906 this paper was not issued until March, 1908.

4.—THE MYRIAPODS OF THE DERWENT VALLEY.

By RICHARD S. BAGNALL, F.L.S., F.E.S.

The creatures included in the group familiarised to naturalists under the name of "Myriapoda," fall into four Orders of which two—the Chilopoda or Centipedes and Diplopoda or Millipedes are well-known to most of us. The inter-relationship of these four Orders, however, is not so close as might be supposed from the fact that they are thus grouped together; in fact the Chilopods and Diplopods are really widely separated in the modern classification of the Arthropods, and we still retain the term "Myriapoda," not because there is any real justification for doing so, but more as a matter of convenience.

I have recently collected and studied these creatures and hope shortly to publish an account of the Northumberland and Durham species. The following records are of those species that have occurred within the confines of our little valley, no less than fifty-five forms in all. These creatures have been curiously neglected by British naturalists, and will well repay the attention of anyone who wishes to carry out original work.

Order CHILOPODA.

This order contains the common centipede and its allies (easily recognised by their short bodies which carry fifteen pairs of legs), and the very long, slender, many-legged Geophilids so often seen curled up under stones, bark, etc. Three Lithobiids are additions to the British fauna, *L. duboscqui*, Brölemann; *L. piceus*, subspecies *britannicus*, Bagn. (which Mons. Brölemann says may be referable to a new species, but on account of the difficulty of the group to which it belongs, he suggests that it should be regarded as a new variety or subspecies of *piceus*), and *L. nigrifrons*, Latz. & Haase.

Family **LITHOBIIDÆ.**

Genus Lithobius (Leach).

L. crassipes (L. Koch).

Common and widely distributed.

L. microps (Mein.)

A Winlaton example is almost certainly referable to the true *microps*, possessing, as it does, 32 antennal joints, the maximum number in the following species being 28. I have not had the opportunity of studying this specimen since M. Brölemann has pointed out to me that the specimens with fewer antennal joints are his *L. duboscqui*.

L. duboscqui (Brölemann).

A few examples from the Durham side of the Derwent, near Blanchland, March, 1913. Not previously recorded as British.

L. calcaratus (C. Koch).

Rare. I have an example (♀) from Gibside taken in 1906.

L. forficatus (L.)

This is the common large centipede, and is to be found throughout the area, not only near habitations, but in fields and woods, and on the moors.

L. piceus subspecies *britannicus* (Bagn.) nov.

I first discovered this fairly large and distinct form (recognised on the field by its bright yellow tibiæ) on the Blanchland Moors in March of this year (1913), and a fortnight later took further examples on Buckshott Moor near Hunstanworth (Co. Durham), and on Cowbyers Fell, Blanchland Moor (Northumberland). Dr. Brölemann, to

whom I submitted specimens considers it advisable to describe it as a form of *piceus* (a species not yet recorded as British) though it may ultimately prove to be a new species

L. variegatus (Leach).

Not uncommon in wooded districts, Axwell, Winlaton Mill, Swalwell, Gibside, Lintz Green, Chopwell, Ebchester, Buckshott Moor at over 1200 feet, and Shildon Burn, near Blanchland. A fine species which is apparently confined to the British Islands.

L. nigrifrons (Latz. and Haase).

Two mutilated specimens found in a field between Hollinside and Gibside in 1906, are apparently referable to this species. As this is the only British record I hope to secure further specimens.

L. glabratus (C. Koch) (*melanops*, Newp.)

Very frequently found, especially under bark of old, rotting fir stumps; Blanchland, Buckshott Moor, near Hunstanworth, Ebchester, Chopwell, Gibside, Winlaton and Brockwell.

Genus Henicops (Newp.)

H. fulvicornis (Mein.)

One ♀ Buckshott Moor near Hunstanworth March 29th, 1913, at about 1,400 feet above sea level.

Family **SCOLOPENDRIDÆ.**

Genus Cryptops (Leach .

C. hortensis (Leach).

Usually found in greenhouses. I have taken examples at Newcastle and Winlaton.

Family GEOPHILIDÆ.

Genus Geophilus (Leach).

G. longicornis (Leach)=*flavus* (De G.)

Common and widely distributed.

G. proximus (C. Koch).

Common, though not so frequent as *longicornis*.

G. carpophagus (Leach).

A common species on moors and in uncultivated places, and also on the sea-shore. On the moors between Shotley Bridge and Hunstanworth and on Blanchland Common.

G. truncorum (Bergs. & Mein.)

A small species usually found under stones and bark of stumps in woods; Brockwell, Winlaton, Axwell, Swalwell, Winlaton Mill, Gibside, Chopwell, Ebchester, Hunstanworth and Blanchland.

Genus Scolioplanes (Bergs. et Meinert)

S. crassipes (C. Koch).

Gibside, 2 ♂'s and 5 ♀'s, May, 1911. This is the only record for the counties of Northumberland and Durham.

Another species, *S. maritimus*, is very frequent on the sea-shore, though local, whilst a third species, *acuminatus*, has occurred at Blackhall Rocks.

Genus Schendyla (Bergs. et Meinert).

S. nemorensis (C. Koch).

A small and somewhat rare species met with very infrequently under stones in woods, Gibside and Winlaton.

Genus Stigmatogaster (Latzel).

S. subterraneus (Leach).

This, the largest of our local "wire" centipedes, is probably often turned up when digging in gardens, though I can only give one Derwent Valley record, namely a few examples from a Winlaton garden, 1906. I have also met with it in Newcastle.

Genus Mecistocephalus (Newp.)

M. carniolensis (C.K.)

I once took several examples of this Geophilid in hot-houses, Leazes Park, Newcastle. Mr. Evans records it from Edinburgh hothouses.

ORDER SYMPHYLA.

White centipede-like creatures with 12 (in some cases 11) pairs of legs, ranging from $1\frac{1}{2}$ to about 8 millemetres in length, and usually found under stones more or less deeply embedded in earth.

I have recently made a somewhat special study of the Order, and the classification here adopted is that forming the subject of a paper I recently submitted to the Linnean Society.*

Family **SCOLOPENDRELLIDÆ.**

Sub-Family SCUTIGERELLINÆ Bagnall.

Genus Scutigerella Ryder.

S. immaculata (Newp.)

Our largest and perhaps most widely distributed species of the family. Local but not uncommon; Axwell Park

* Journ. Linn. Soc., Zool., xxxii., pp. 159–199, October, 1913.

and Gibside, Edmundbyers and Shildon Burn, near Blanchland. Until recently *S. immaculata* was the only recognised species of Symphyla in the British Isles.

S. spinipes Bagnall.

Described from Teesdale and taken as near our borders as Stocksfield-on-Tyne, this species will almost certainly be met with in the Derwent Valley.

S. biscutata Bagnall.

Described from the Wear Valley and since recorded from many localities in the North of England and Scotland.

I have local specimens from Gibside Woods taken in the spring of 1912.

Genus Neoscutigerella Bagnall.

N. hanseni (Bagnall).

Described from an adult example taken with *S. immaculata* in a quarry, Axwell Park.

Genus Hanseniella Bagnall.

H. caldaria (Hansen).

A hothouse species taken at Ravensworth and Newcastle.

Sub-Family SCOLOPENDRELLINÆ Bagnall.

Genus Scolopendrellopsis Bagnall.

S. subnuda (Hansen).

A minute form which is not uncommon in some localities and widely distributed in England. Winlaton Mill and Gibside.

Another European species, *S. microcolpa* (Muhr) will probably yet be met with in the British Isles, whilst *Scolopendrella notacantha* (Gervais) recorded from Cheshire, will probably occur locally.

Genus Symphylella Silvestri. (Bagnall).

S. dunelmensis (Bagnall).

A rather large form which occurs in numbers in Gibside but has not yet been found anywhere else. Two allied species, *S. isabellae* (Grassi) and *S. jacksoni* (Bagnall) have been taken at Penshaw and Chester respectively, whilst another species, *S. horrida* (Bagnall) has been described from Hart.

S. vulgaris (Hansen).

I find this species to be the most common of the group, and it has occurred in the Derwent Valley at Gibside, Fellside, Winlaton, Winlaton Mill, Axwell Park, and Hunstanworth, near Blanchland.

S. delicatula (Bagnall).

A rare but widely distributed species, small and very slender, and originally described from Wear Valley specimens. Local examples are from Fellside and Newcastle, and Axwell Park. The specimen from the last named locality was taken by my friend Mr. H. S. Wallace. Another and very minute species. *S. minutissima* (Bagnall) has been taken in Teesdale and Yorkshire.

ORDER PAUROPODA.

The minute and curious animals composing this Order have been studied by few naturalists, and there is ample scope for valuable original work in this field. Most of the species are less than one millemetre in length, and are in reality, not uncommon, especially in rich soils, and amongst frass under bark of deciduous trees lying in damp situations.

I have taken seven species (in other words all the British species as yet known) in the Wear Valley, which is especially rich in "earth dwelling" Arthropods on account, I think, of its proximity to the limestone formation.

Family PAUROPODIDÆ.

Genus Stylopauropus Cook.

S. pedunculatus (Lubbock).

Winlaton Mill, one example. Also known from the Wear Valley.

Genus Pauropus Lubbock.

P. huxleyi Lubbock.

The first specimen of *huxleyi* I ever saw was taken under the bark of a tree stump on the Scaur banks, Winlaton Mill, whilst more recently (December, 1911) I have taken several examples under similar conditions in Gibside.

Genus Allopauropus Silvestri.

A. vulgaris (Hansen).

The first recorded British examples of this small species, which is rarer with us than *gracilis*, were taken near Mitford, Northumberland. It occurs sparingly at Gibside, Winlaton, Winlaton Mill, Blaydon and Newcastle-upon-Tyne

A. gracilis (Hansen).

One of our commonest and most widely distributed British species, often occurring in large numbers amongst the damp frass found unner the bark of rotten oak logs. Very common in Gibside, where I took the first British specimens on October 4th, 1907, and common in other parts of the Valley.

ORDER DIPLOPODA.

Members of this Order compose the millipedes proper, of which our species fall into three more or less natural groups, which we may roughly call the "Pill-millipedes" (*Glomeridæ*), the "Square-backed millipedes" (*Polydesmidæ, Brachychæteumidæ*, and *Chordeumidæ*) and the

"Cylindrical millipedes" (*Julidæ* and *Protoiulidæ*) some of which are commonly called "false wire-worms." The Pill-millipedes curiously resemble the Pill-Woodlice (*Armadillidium*). Amongst the square-backed forms I have been particularly fortunate in discovering several noteworthy additions to the British fauna :—*Brachychæteuma bagnalli*, described by Verhoeff as the type of a new genus and family, from a Gibside specimen ; the small *Titanosoma jurassicum*, Verh. ; *Polydesmus coriaceus*, Porat (from near Darlington) ; *Microchordeuma*, sp., and *Craspedosoma simile*, Verh. In the *Protoiulidæ Isobates varicornis*, C.K. (Gibside) and *Napoiulus* sp. (Fencehouses) were first recorded as British from Durham captures.

Genus **GLOMERIDÆ.**

Genus Glomeris Latr.

G. marginata (Villiers).

This, the common pill-millipede, is not uncommon and is to be found throughout the area.

G. marginata var. *perplexa.*

A small, prettily marked and very distinct form is referred to the var. *perplexa* by Prof. Verhoeff, whilst another authority refers it to a distinct species. I have taken it occasionally in woods at Gibside and Winlaton as well as in Teesdale and in the Clyde area of Scotland, and my specimens are as yet the only known British examples.

Family **POLYDESMIDÆ.**

Genus Polydesmus Latr.

P. complanatus (L.)

A large, square-backed millipede and the commonest of the family.

P. denticulatus (C. Koch).

Rare. A few Gibside examples are the only local ones I have seen. I have taken a third species, *P. coriaceus* (Porat), from a mole's nest, Bradbury, near Darlington.

Genus ORTHOMORPHA.

O. gracilis (C.L.K.)

A common hothouse species, Newcastle, Ravensworth, and Winlaton Mill.

Genus BRACHYDESMUS Heller.

B. superus Latzel.

Not uncommon, Axwell, Winlaton Mill, Gibside, Chopwell, Shotley Bridge, Edmundbyers, Hunstanworth and in the neighbourhood of Blanchland. It occurs in a variety of habitats and often occurs in numbers in the wet bottoms of old haystacks.

Genus TITANOSOMA Verhoeff.

T. jurassicum Verhoeff.

Females only. In numbers from gardens, Fellside and Gibside, and one example from the Gibside woods. This species was only described by Verhoeff in 1910 from a single example (♀) taken on the Danube, and very shortly afterwards I found it in large numbers in a very restricted area in a Wear Valley dene. It is one of our smallest Diplopods and is apparently widely distributed. I have seen "wild" examples from Scotland, and three Durham localities and garden specimens from Northumberland, Durham, Cheshire and Oxfordshire.

FAMILY **BRACHYCHÆTEUMIDÆ** Verhoeff.

Genus BRACHYCHÆTEUMA Verhoeff.

B. bagnalli Verhoeff.

One ♂, Gibside Woods. A fair-sized species, which (being blind) may have its proper home deep down in the

earth. The single example, fortunately a male, was not only the type of a new genus and species, but also of a new family.

Family **CHORDEUMIDÆ.**

Genus *Microchordeuma* Verhoeff.

Microchordeuma sp., (*silvestre* K.)

One ♀, Gibside.

Genus Polymicrodon Verhoeff.

P. latzeli (Verhoeff).

This species is not uncommon but local in the North of England, and much commoner than the following species. Axwell, Winlaton, Gibside, Friarside, etc.

Genus Atractosoma Fanz.

A. polydesmoides (Leach).

I have only seen a few local examples of the species I regard as *A. polydesmoides*. I think that most of the specimens of *A. polydesmoides* recorded by British writers will be found to be referable to *P. latzeli*. There are distinctly two species, of which this is much the rarer one, and I hope to have the opinion of Prof. Verhoeff (who has written at some length in a recent paper on my *P. latzeli* material) on this matter before I publish my account of the Northumberland and Durham Myriapods.

Genus Craspedosoma (Leach).

C. rawlinsi (Leach).

Two specimens found under a stone, half submerged, in Snipe's Dene, Gibside, 1907, are apparently referable to *C. rawlinsi*.

C. simile (Verhoeff).

Added to the British list on several examples found under the loose bark of a fallen tree lying in a damp situation. Gibside, 1912, together with the subspecies *rhenanum*.

C. simile rhenanum (Verhoeff).

Found with the typical form.

Family **JULIDÆ.**

Genus Julus (s.l.) Brandt.

J. ligulifer (Latz.-Verh.)

Gibside, ♂ and ♀, rare.

J. sabulosus (L.)

I have occasionally seen this large species, easily recognised by the pair of ferrugineus dorsal stripes, in woods at Winlaton Mill and Gibside.

J. albipes (C.L.K.)=*niger* Leach.

Another large millipede. Common and widely distributed.

J. punctatus (Leach)=*silvarum* Mein.

Very common, especially under bark and in rotten logs. It also occurs in numbers in the walls of the wood-ant's nests at Chopwell and Ebchester.

J. luscus Meinert.

Gibside, both sexes. A rare species of which this is my only record for the counties of Northumberland and Durham.

J. fallax Meinert.

Gibside, females only. Not common.

Family **PROTOIULIDÆ.**

Genus Blaniulus Gervais.

B. pulchellus (C. L. Koch)=*venustus* (Mein.)

Gibside, 1 ♂ and 1 ♀, August, 1911 ; 2 ♀'s, June, 1912. A rare British species.

Genus Amsteinia (Verhoeff).

A. fuscus (Amstein).

Females only ; common under bark of trees, especially conifers. Blanchland, Ebchester, Friarside, Gibside, Winlaton, etc.

Genus Isobates (Menge).

I. varicornis (C. Koch).

7 ♀'s and young found under the bark of a fallen fir tree in Gibside, May, 1911, are the first British specimens recorded. It is not uncommon in Gibside, and has since occurred in other parts of England.

Genus Trichoblaniulus Verhoeff.

T. guttulatus (Bosc.)

Common and widely distributed ; both sexes. This species is often to be found in large numbers in gardens where they do much damage to young and tender plants.

5.—PRELIMINARY LIST OF SPIDERS, HARVESTMEN, AND PSEUDO-SCORPIONS FOUND IN THE DERWENT VALLEY.

BY RICHARD S. BAGNALL, F.L.S. AND W. LEONARD TURNER.

In the winter of 1905-1906, when Dr. Randell Jackson was on the point of publishing his account of "The Spiders of Tynedale," one of us (R.S.B.) though primarily engaged in other subjects, was tempted to collect spiders in the precincts of the Derwent Valley. This collecting was carried on intermittently until 1909, but almost entirely during the winter months, and the spiders so captured were very kindly identified by Dr. Randell Jackson. As some were not without interest Dr. Jackson has published notes of the more notable captures which will be found by reference to his numerous papers on British Spiders.

One of the most interesting captures was that of *Diplocephalus protuberans* (Camb.) taken in December, 1906 an addition to the British fauna, whilst several others such as *Cnephalocotes interjectus, Ballus depressus, Dictyna variabilis, Hilaira frigida, Eugnatha striata,* and the pseudo-scorpions *Chthonius rayi* and *Chthonius tetrachelatus* were additions to the Northumberland and Durham lists.

Since then this work has been taken up by the junior author, who has already increased the list and hopes to collect in the Valley more widely and systematically so that ultimately we may have more accurate knowledge of its spider fauna. In this work he has the great assistance of the Rev. J. E. Hull's expert aid and advice. It has been felt however, that a preliminary list of captures would be both desirable and useful.

During the compilation of this list we worked together in the early spring of this year in the higher reaches of the Valley—on one occasion joined by our friend Mr. H. S. Wallace, F.E.S., and thus were able to confirm most of Dr. Randell Jackson's Blanchland records and make several

interesting additions to our list such as *Lycosa nigriceps*, *Panamomops bicuspis*, *Coryphaeus simplex*, *Leptyphantes obscurus*, *Linyphia pusilla* and *Tetragnatha extensa*, whilst Mr. Wallace and the senior author found *Porrhomma egeria* and undoubted examples of the newly described *Porrhomma pallidum* (Jackson) in the lower parts of the Valley during the same period.

Altogether we are now able to record 208 spiders, 12 harvestmen and 3 pseudo-scorpions.

Our warmest thanks are due to Dr. A. Randell Jackson and the Rev. J. E. Hull for their whole-hearted assistance in examining our captures.

ORDER I.—ARANEÆ (Spiders.)

FAMILY DYSDERIDÆ.

Harpactes Hombergii (*Scop.*).

Gibside (R.S.B.).

Segestria senoculata (*L.*).

Winlaton Mill, Gibside, Swalwell, and near Blanchland (R.S.B. & W.L.T.).

FAMILY OONOPIDÆ.

Oonops pulcher (*Templ.*).

Blanchland, 1 ♂, April, 1906; Winlaton, both sexes, March, 1906; Axwell Park, in haystack refuse, March, 1913 (R.S.B.).

FAMILY DRASSIDÆ.

Prosthesima Latreillii (*Sim.*).

Occasionally under stones on Blanchland Common (A.R.J.).

Drassodes cupreus (*Bl.*)

Winlaton, 1 ♀, March, 1906 (R.S.B.); Blanchland Common, 1 juv., March, 1913 (R.S.B. & W.L.T.)

Drassodes troglodytes (*Koch.*)

Spen Banks, Winlaton Mill and Blanchland Common, in June, 1907, and July, 1909. Numerous (R.S.B. & W.L.T.)

Gnaphosa anglica (*Camb.*)

Blanchland Common, under stones and turves, in May, June and July (A.R.J.); females only on Cowbyers' Fell and Blanchland Common (Northd.) on March 30th, 1913 (R.S.B. & W.L.T.)

Clubiona reclusa (*Camb.*)

In numbers, Winlaton and Blanchland (R.S.B. & W.L.T.)

Clubiona grisea (*Koch.*)

Spen Banks, females only, June, 1907 (R.S.B.)

Clubiona lutescens (*Westr.*)

Blanchland, September, 1909, common with *reclusa* (W.L.T.); Lady's Steps, Swalwell, under loose bark, March, 1913 (R.S.B.)

Clubiona brevipes (*Bl.*)

Gibside (R.S.B.)

Clubiona comta (*C. L. K.*)

Common throughout area.

Clubiona diversa (*C. L. K.*)

Hunstanworth, April, 1906, 1 ♀ (R.S.B.)

Chiracanthium carnifex (*Fabr.*)

Taken in Derwent Valley, but note of locality mislaid (R.S.B.)

CHIRACANTHIUM LAPIDICOLENS (*Sim.*)

Single adult female, under stone, Blanchland Common, in June (A.R.J.); adult female, May, 1909, Axwell Park (W.L.T.)

ANYPHOENA ACCENTUATA (*Walck.*)

Gibside, ♀ and young, December, 1905 (R.S.B.)

AGROECA BRUNNEA (*Bl.*)

Neighbourhood of Winlaton (R.S.B.)

AGROECA PROXIMA (*Camb.*)

Winlaton, February, 1906, 1 ♀ (R.S.B.)

ZORA SPINIMANA (*Sund.*)

Gibside, at roots of heath (R.S.B.)

MICARIA PULICARIA (*Sund.*)

Above Hunstanworth, 1 ♂, April 15th, 1906 (R.S.B.)

FAMILY THOMISIDÆ.

XYSTICUS CRISTATUS (*Clk.*)

Common, especially in haystack refuse.

XYSTICUS SABULOSUS (*Hahn.*)

An immature ♀, Blanchland Common, June (A.R.J.)

OXYPTILA TRUX (*Bl.*)

Gibside (R.S.B.)

OXYPTILA PRATICOLA (*Koch.*)

Winlaton, 1 ♂ (R.S.B.)

PHILODROMUS AUREOLUS (*Clk.*)

Common throughout area, especially on gorze.

PHILODROMUS CAESPITICOLIS (*Walck.*)

Chopwell Woods (R.S.B.)

FAMILY ATTIDÆ.

EPIBLEMUM SCENICUM (*Clk.*)

Gibside, Winlaton and Blaydon (R.S.B.)

EPIBLEMUM CINGULATUM (*Panz.*)

1 ♀ in Derwent Valley, locality not known (R.S.B.)

BALLUS DEPRESSUS (*Walck.*)

West Woods, Gibside, 1 ♀. This capture was made with two others equally unexpected and remarkable, namely *Dictyna variabilis* and *Eugnatha striata*, all three new to the fauna of the North of England (R.S.B.)

NEON RETICULATUS (*Bl.*)

Gibside and Axwell Park Wall (R.S.B.)

EUOPHRYS ERRATICUS (*Walck.*)

Winlaton (R.S.B.)

HASARIUS ADANSONII (*Sav.*)

In hothouses at Winlaton Mill and Ravensworth (R.S.B.)

FAMILY AGELENIDÆ.

CRYPHÆCA SILVICOLA (*C.L.K.*)

Common throughout area.

CŒLOTES ATROPOS (*Walck.*)

Common throughout area.

ARGYRONETA AQUATICA (*Latr.*)

Gibside, Lily Pond. Mr. Herd records the Water Spider from the Lily Pond, and many years ago I brought up what I presume to be this spider whilst dragging the pond for water beetles (R.S.B.)

TEGENARIA DERHAMII (*Scop.*)

Common in houses, Winlaton, Swalwell, Gibside, and Blanchland.

Tegenaria atrica (*C. L. K.*)

A Winlaton example is in Newcastle Museum; Axwell Park greenhouses, 2 immatures, December, 1910 (W.L.T.)

Cicurina cinerea (*Panz.*)

Winlaton ♀s, January and February, 1906 (R S.B.)

Textrix denticulata (*Oliv.*)

Axwell Park Wall (R.S.B.)

FAMILY HAHNIIDÆ.

Antistea elegans (*Bl.*)

Dead rushes, Lockhaugh and Spen Banks (R.S.B.)

Hahnia montana (*Bl.*)

Females only, Winlaton, December, 1905, and Gibside in June, 1906, and April, 1913 (R.S.B.)

FAMILY LYCOSIDÆ.

Pirata piraticus (*Clk.*)

This and the following species occur in marshy places. Winlaton, March, 1907, and Spen Banks in June, 1906 (R.S.B.)

Pirata hygrophilus (*Thor.*)

Swampy wood near Winlaton (R.S.B.)

Trochosa ruricola (*De Geer*).

Winlaton, Winlaton Mill and Spen Banks (R.S.B. & W.L.T.)

Trochosa terricola (*Thor.*)

Winlaton Mill and Spen Banks, females only (R.S.B.)

Trochosa picta (*Hahn.*)

Sandy places on Blanchland Common (A.R.J.); Spen Banks and Winlaton Mill (R.S.B.)

TROCHOSA CINEREA (*Fabr.*)

Blanchland, (Northd.) among shingle, September, 1910, 1 ♂ (W.L.T.)

TARENTULA PULVERULENTA (*Clk.*)

Shotley Bridge, common (W.L.T.)

TARENTULA ANDRENIVORA (*Walck.*)

Common throughout area.

LYCOSA AMENTATA (*Clk.*)

Also common.

LYCOSA AGRICOLA (*Thor.*)

On shingle bed near river, Winlaton Mill (R.S.B.); and Blanchland (Northd.) shingle, September, 1910 (W.L.T.)

LYCOSA PULLATA (*Clerck*).

Numerous.

LYCOSA LUGUBRIS (*Walck*).

Gibside (R.S.B.)

LYCOSA PALUSTRIS (*Linn.*)

Winlaton (R.S.B.)

LYCOSA HERBIGRADA (*Bl.*)

Several females in June, Blanchland Common (A.R.J.)

LYCOSA NIGRICEPS (*Thor.*)

One example, Roughside, March 16th, 1913 (R.S.B. & W.L.T.)

FAMILY DICTYNIDÆ.

DICTYNA VARIABILIS (*C. L.K.*)

Gibside, both sexes, spring, 1909. An unexpected addition to our north country fauna. Previously regarded as a purely southern form (R.S.B.)

DICTYNA UNCINATA (*Westr.*)

Female specimen from Derwent Valley (R.S.B.)

DICTYNA ARUNDINACEA (*Linn.*)

Blanchland (Northd.), September, 1910, numerous (W.L.T.); juveniles in numbers on gorse at Shildon Burn, near Blanchland, March, 1913 (R.S.B. & W.L.T.)

AMAUROBIUS FENESTRALIS (*Strœm*).

Common throughout area.

AMAUROBIUS SIMILIS (*Bl.*)

Winlaton, Axwell and Gibside in cellars and outbuildings, June, 1906 (R.S.B.); 1 ♀ in haystack refuse, The Snods, near Shotley Bridge, and 1 ♀ in an outbuilding at Blanchland, March, 28th 1913 (R.S.B. & W.L.T.)

AMAUROBIUS FEROX (*Walck.*)

Winlaton, apparently rare (R.S.B.)

FAMILY MIMETIDÆ.

ERO FURCATA (*Vill.*)

Winlaton and Gibside, occasionally (R.S.B.)

FAMILY THERIDIIDAE.

THERIDION TEPIDARIORUM (*C. L. K.*)

Immatures from Axwell greenhouses, December, 1910 (W.L.T.); in a greenhouse near Winlaton (R.S.B.)

THERIDION LINEATUM (*Bl.*)

Common.

THERIDION DENTICULATUM (*Walck.*)

Immature males, Lockhaugh, April, 1906 (R.S.B.)

THERIDION VARIANS (*Hahn.*)

Abundant.

THERIDION SISYPHIUM (*Clerck*).

Common throughout area.

THERIDION PALLENS (*Bl.*)
Gibside and Winlaton (R.S.B.)

STEATODA BIPUNCTATA (*Linn.*)
In a cellar, Winlaton (R.S.B.); Winlaton Mill, August, 1911 (W.L.T.)

ROBERTUS LIVIDUS (*Bl.*)
Females only, Gibside, Winlaton and Blanchland, and both sexes, Axwell, March, 1913 (R.S.B.); Shotley Bridge, April, 1911, ♀ (W.L.T.); Cowbyer Fell, Blanchland Common (Northd.) and Buckshott Moor at 1,400 feet, March 30th, 1913, both sexes (R.S.B. & W.L.T.)

ROBERTUS ARUNDINETI (*Camb.*)
Females with their egg sacs, in July, on Blanchland Common (A.R.J.)

ENOPLOGNATHA THORACICA (*Hahn.*);
Taken locally (R.S.B.)

PHOLCOMMA GIBBUM (*Westr.*)
Axwell Park, March, 1906, 1 ♂; Gibside, ♀'s (R.S.B.); Hunstanworth, in haystack refuse, 1 ♂; and by beating conifers, 1 ♀ in March, 1913 (R.S.B. & W.L.T.)

ONESINDA MINUTISSIMA (*Camb.*)
Winlaton, May, 1907 (R.S.B.)

FAMILY ARGIOPIDÆ.

SUB-FAMILY I., LINYPHIINÆ.

CERATINELLA BREVIS (*Wid.*)
Both sexes, Winlaton, February and near Blanchland in April, 1906 (R.S.B.); 1 ♀, Durham banks of the Derwent near Blanchland, March, 1913 (R.S.B. & W.L.T.)

CERATINELLA BREVIPES (*Westr.*)
Both sexes, Chopwell, May, 1907. (R.S.B.)

LOPHOCARENUM MENGII (*Sim.*)
One of our rarer spiders, 1 ♀ in April, 1906, Blanchland (R.S.B.)

CNEPHALOCOTES INTERJECTUS (*Cb.*)
One ♂ taken in Gibside, March, 1907; apparently very rare in the north (R.S.B.)

CNEPHALOCOTES OBSCURUS (*Bl.*)
Winlaton in February, 1906, (R.S.B.); By beating gorse 1 ♂ Shildon Burn, near Blanchland (Northd.) and 1 ♂ in haystack refuse at Snods near Shotley Bridge, March, 1913 (R.S.B. & W.L.T.)

TISO VAGANS (*Bl.*)
Occasionally Winlaton, Axwell and Gibside (R.S.B.)

ERIGONELLA HIEMALIS (*Bl.*)
Winlaton, ♂, February, 1906 (R.S.B.)

CALEDONIA ALIENA (*Kulcz.*) Sub-species EVANSII (*Camb.*)
Blanchland Common (Northd.) among short heather (A.R.J.); on the moors Blanchland Common (Northd) and Buckshott Fell, ♀'s only, March, 1913 (R.S.B. & W.L.T.)

SAVIGNIA FRONTATA (*Bl.*)
Common throughout area.

DIPLOCEPHALUS CRISTATUS (*Bl.*)
Common.

DIPLOCEPHALUS PERMIXTUS (*Camb.*)
April 15th, 1906, 1 ♂ near Blanchland (R.S.B.)

DIPLOCEPHALUS LATIFRONS (*Camb.*)
Females from Spen Banks, January, and Blanchland in April, 1906; Gibside, 1 ♂, April, and Axwell, ♂, March, 1913 (R.S.B.); 1 ♂ from Durham side of Derwent near Blanchland, March, 1913 (R.S.B. & W.L.T.)

DIPLOCEPHALUS FUSCIPES (*Bl.*)
Apparently common.

Diplocephalus picinus (*Bl.*)
Females, Winlaton and Gibside, March and April and Winlaton Mill, 1 ♂, June, 1906; and Winlaton Mill, August, 1911 (R.S.B. & W.L.T.)

Diplocephalus Beckii (*Camb.*)
Axwell Park, July, 1910, under loose bark of old tree. Rare in the valley (W.L.T.)

Diplocephalus protuberans (*Camb.*)
Gibside, December, 1906, 1 ♂ taken amongst waterfall moss in Snipes dene. Then new to the British fauna but has recently been recorded from Yorkshire. Previously known from France and Bavaria (R.S.B.)

Troxochrus scabriculus (*Westr.*)
On shingle bed near river at Winlaton Mill (R.S.B.)

Troxochrus præcox (*Camb.*)
Under stones on Blanchland Common (A.R.J.); Chopwell, ♂, May, 1907 (R.S.B.)

Troxochrus subitaneus (*Camb.*)
In very dry haystack refuse on the moors at Hunstanworth, ♂, April 15th, 1906, and in Axwell Park, March, 1913 (R.S.B.)

Troxochrus exilis (*Bl.*)—*Tapinocyba pallens* (Camb.)
Winlaton, Winlaton Mill, Spen Banks, Gibside, Ebchester and around Blanchland chiefly in pine-needle refuse (R.S.B.)

Lophomma punctatum (*Bl.*)
January, 1907, at Lockhaugh (R.S.B.)

Lophomma herbigradum (*Bl.*)
Winlaton, December, 1906, Gibside and Axwell, females only (R.S.B.); in loose moss in a wood near Hunstanworth, March, 1913, 1 ♀ (R.S.B. & W.L.T.); both sexes in Gibside, April, 1913 (R.S.B.)

Dicymbium nigrum (*Bl.*)
Common.

Dicymbium tibiale (*Bl.*)
Also common.

Pocadicnemis pumila (*Bl.*)
Occasionally (R.S.B.); in grass Axwell Park, June, 1910 (W.L.T.)

Peponocranium ludicrum (*Camb.*)
Gibside, January, 1906; Winlaton, ♂, in May, 1907 (R.S.B.)

Metopobactrus prominulus (*Camb.*)
Rare. An immature specimen, presumably female, at Winlaton in March, 1906 (R.S.B.)

Minyriolus pusillus (*Wid.*)
Both sexes in moss, Barlow, Gibside, and Blanchland (R.S.B.)

Panamomops bicuspis (*Camb.*)
Haystack refuse, 1 ♂, Hunstanworth, in March, 1913 (R.S.B. & W.L.T.)

Entelecara erythropus (*Westr.*)
Winlaton and Gibside, April, 1906; common on shrubs, etc. (R.S.B.)

Thyreosthenius biovatus (*Camb.*)
In nests of the wood ant (*Formica rufa*), Chopwell and near Ebchester (R.S.B. & W.L.T.). I have taken an adult ♂ and young ♀ from herbage in low-lying flats at Lockhaugh, at least two miles away from the nearest nests of *F. rufa*. Bold records the wood ant from Gibside (opposite Lockhaugh) but I have never seen it there (R.S.B.)

Evansia merens (*Camb.*)
With *Formica fusca* Winlaton, January, 1906 (R.S.B.)

Wideria antica (*Wid.*)
Females from near Winlaton, February and April, 1906; Axwell Park, March, 1913 (R.S.B.); Winlaton Mill, ♀, August, 1911 (W.L.T.)

WIDERIA CUCULLATA (*C.L.K.*)

In woods near Winlaton and Barlow amongst fallen pine needles; ♀, Hunstanworth, April, and ♂, Chopwell, May, 1907 (R.S.B.); amongst loose moss and herbage on the Durham banks of Derwent, near Blanchland, March 16th, 1913 (R.S.B. & W.L.T.)

PROSOPOTHECA MONOCEROS (*Wid.*)

Blanchland (Northd.) both sexes in moss, October (A.R.J.); Blanchland Common (Northd.) both sexes, March 15th, 1913 (R.S.B. & W.L.T.)

CORNICULARIA CUSPIDATA (*Bl.*)

Rather common; Chopwell, Spen Banks, Gibside, Winlaton, Axwell and Blanchland (R.S.B. & W.L.T.)

CORNICULARIA UNICORNIS (*Camb.*)

Both sexes, February and June, 1906, Winlaton (R.S.B.)

CORNICULARIA VIGILAX (*Bl.*)

Blanchland Common, both sexes (A.R.J.); Winlaton, ♀, December, 1905 and ♂'s in February, 1906 (R.S.B.)

WALCKENAERA ACUMINATA (*Bl.*)

Common throughout the area.

WALCKENAERA NUDIPALPIS (*Westr.*)

Gibside, ♀, December, 1905; Winlaton several males in March, 1906 (R.S.B.); two females, Blanchland Common, March 15th, 1913 (R.S.B. & W.L.T.)

WALCKENAERA OBTUSA (*Bl.*)

A very rare British spider. Winlaton, both sexes, December, 1905, January and February, 1906; Gibside, ♂, March 17th, 1906 (R.S.B.)

GONATIUM RUBENS (*Bl.*)

Common.

GONATIUM RUBELLUM (*Bl.*)

Near Winlaton and on Spen Banks (R.S.B.); females only in haystack refuse at Snods, and in moss near Hunstanworth, March, 1913 (R.S.B. & W.L.T.)

Enidia bituberculata (*Wid.*)
Common.

Enidia cornuta (*Bl.*)
By beating hawthorn, yew, etc. in Gibside (R.S.B.); Axwell Park, May, 1909 (W.L.T.)

Dismodicus bifrons (*Bl.*)
Common.

Gongylidium rufipes (*Sund.*)
Common.

Oedothorax fuscus (*Bl.*)
Both sexes at Winlaton (R.S.B.); in marshy field at Redwell Hills, 1 ♂, March, 1913 (R.S.B. & W.L.T.)

Oedothorax retusus (*Westr.*)
Both sexes, Winlaton, Gibside, and Axwell (R.S.B.); one ♂ on Blanchland Common (Northd.) and both sexes in haystack refuse on Durham side of Derwent at Blanchland and Bail Hill, near Hunstanworth, and 1 ♂ in marshy field at Redwell Hills in March, 1913 (R.S.B. & W.L.T.)

Oedothorax gibbosus (*Bl.*)
Spen Banks (R.S.B.)

Oedothorax tuberosus (*Bl.*)
Lockhaugh and Spen Banks (R.S.B.)

Tmeticus dentatus (*Wid.*)
Lockhaugh (R.S.B.)

Gongylidiellum vivum (*Camb.*)
Taken locally in June, 1906 (R.S.B.)

Typhochrestus dorsuosus (*Camb.*)
Blanchland Common, ♀'s only, June, 1903 (A.R.J.)

Erigone dentipalpis (*Wid.*)
Common.

Erigone promiscua (*Camb.*)
Winlaton, June, 1906, ♂ (R.S.B.)

Erigone atra (*Bl.*)

Winlaton Mill (R.S.B.) and females at Blanchland in September, 1910 (W.L.T.)

Erigone arctica (*White*) var. maritima (*Kulcz.*)

In a wood near Winlaton; generally regarded as a seaside form. (R.S.B.)

Maso Sundevallii (*Westr.*)

Common.

Hilaira excisa (*Camb.*)

Females only, Winlaton and Gibside, in December, 1906, and Gibside, April, 1913 (R.S.B.)

Hilaira frigida (*Thor.*)=*montigena* (*C.L.K.*)

Single female example taken locally, an unexpected capture (R.S.B.)

Leptothrix Hardii (*Bl.*)

Both sexes, Blanchland Common (Northd.) (A.R.J.); Blanchland Common (Northd.), 1 ♀, March 15th, 1913 (R.S.B. & W.L.T.)

Leptothrix Huthwaitii (*Camb.*)

Amongst rushes in swampy field, Lockhaugh (R.S.B.)

Oreonetides abnormis (*Bl.*)

Females, Winlaton, December, 1905, and June, 1906, and under stone by Derwent banks at Swalwell, March, 1911, and Gibside (R.S.B.)

Oreonetides firmus (*Camb.*)

In a wood near Winlaton and at Gibside (R.S.B.)

Macrargus rufus (*Wid.*)

Common throughout valley.

Mengia scopigera (*Grube*).

Gibside, females only, December, 1905 (R.S.B.)

Centromerus prudens (*Camb.*)

Single females, Blanchland (Northd.) July and February (A.R.J.); Blanchland Common (Northd.) March 15th, 1913, and 1 ♀ on Cowbyers Fell, and 1 ♀ on Buckshott Moor at about 1,400 feet, March 30th 1913 (R.S.B. & W.L.T.)

Centromerus arcanus (*Camb.*)

Gibside, December, 1906, and Winlaton (R.S.B.)

Centromerus silvaticus (*Bl.*)

Not uncommon, Gibside, Winlaton, and Axwell (R.S.B. & W.L.T.)

Centromerus expertus (*Camb.*)

Females in a swampy wood near Winlaton in January 1906 (R.S.B.)

Centromeria bicolor (*Bl.*)

Common throughout area.

Centromeria concinna (*Thor.*)

Common throughout the area.

Porrhomma pygmæum (*Bl.*)

Females, Winlaton, December, 1905; Axwell, March, 1906 (R.S.B.)

Porrhomma pallidum (*Jackson*).

Both sexes, Gibside, April 12th, 1913 (R.S.B.) It is possible that the following records under *oblongum* (*Camb.*) refer to this new species.

Porrhomma oblongum (*Camb.*)

Spen Banks, ♀, January, 1906 and Gibside in April, 1906, both sexes (R.S.B.)

Porrhomma microphthalmum (*Camb.*)

One female, shingle bed near Winlaton Mill, June, 1906 (R.S.B.) Also taken in moles' nests at Bradbury, March, 1911, and in puffins' nests, Farne Islands, September, 1911 (W.L.T.)

PORRHOMMA EGERIA (*Sim.*)

Two ♀'s, under stone embedded in sandy ground on Derwent banks at Ladies' Steps, near Swalwell (H.S.W. & R.S.B.)

SINTULA CORNIGERA (*Bl.*)

Winlaton, males, December, 1906, and April, 1907, and Spen Banks, January, 1906 (R.S.B.)

CORYPHAEUS SIMPLEX (*F. Camb.*)

A single example of this rarity was found under a stone on the river banks at Eddies' Bridge, near Edmundbyers, March 29th, 1913 (R.S.B.)

AGYNETA CONIGERA (*Cb.*)

Gibside (R.S.B.)

AGYNETA DECORA (*Cb.*)

Winlaton (R.S.B.)

MICRYPHANTES RURESTRIS (*Koch*).

Winlaton, December, 1905, males (R.S.B.)

MICRYPHANTES SAXATILIS (*Bl.*)

Not uncommon.

RHABDORIA DILUTA (*Camb.*)

Winlaton, ♀, December, 1905 ; ♂, April, 1907 ; Spen Banks, females, January, 1906 (R.S.B.) ; in haystack refuse at Bail Hill, near Hunstanworth, March 30th, 1913 (R.S.B. & W.L.T.)

MICRONETA VIARIA (*Bl.*)

Probably common ; Winlaton, both sexes in December, 1906, and Axwell (R.S.B.) ; Blanchland (Northd.), September, 1910 (W.L.T.)

MICRONETA GULOSA (*Koch*)—*sublimis* (Cb.)

Not rare on Blanchland Common (Northd.) where adults may be found in June and July (A.R.J.) ; Buckshott Moor, 1 ♂ at 1,400 feet, March 30th, 1913 (W.L.T.)

BATHYPHANTES NIGRINUS (*Bl.*)

Plentiful.

Bathyphantes gracilis (*Bl.*)
Common.

Bathyphantes approximatus (*Camb.*)
Spen Banks (R.S.B.)

Bathyphantes concolor (*Wid.*)
Common throughout valley.

Poeciloneta globosa (*Wid.*)—*Bathyphantes variegatus* (Bl.)
Winlaton, December, 1906; Gibside and Axwell (R.S.B.)

Leptyphantes ericæus (*Bl.*)
Common.

Leptyphantes pallidus (*Camb.*)
Gibside, females in moss of waterfalls with *Meta merianæ*, January, 1906 onwards. Cellar, April, 1913, both sexes, Gibside (R.S.B.); Lockhaugh, May, 1911 (W.L.T.)

Leptyphantes obscurus (*Bl.*)
By beating conifers, both sexes on March 16th, 1913, at Hunstanworth (R.S.B. & W.L.T.)

Leptyphantes Mengii (*Kulzc.*)
Winlaton, January, 1906, female (R.S.B.)

Leptyphantes tenuis (*Bl.*)
Very common.

Leptyphantes Zimmermani (*Kulcz.*)
Common throughout area.

Leptyphantes cristatus (*Menge*).
Not uncommon.

Leptyphantes alacris (*Bl.*)—*terricola* (*K.*)
Gibside, males, January, 1906, and both sexes later (R.S.B.); Chopwell, May, 1910, numerous amongst grass and dead leaves (W.L.T.)

Leptyphantes leprosus (*Ohl.*)
Winlaton, females, December, 1905, and Lockhaugh, male, April, 1906 (R.S.B.); in a cellar at Edmundbyers, March 16th, 1913 (R.S.B. & W.L.T.)

LEPTYPHANTES MINUTUS (*Bl.*)

Common at Winlaton, Gibside, and Axwell Park (R.S.B. & W.L.T.)

LABULLA THORACICA (*Wid.*)

Young from Gibside, January, 1906 and April, 1913 (R.S.B.); females in loose moss on Durham side of Derwent at Blanchland, March 16th, 1913 (R.S.B. & W.L.T.) in all cases with *Meta merianæ*.

LINYPHIA CLATHRATA (*Sund.*)

Common.

LINYPHIA MONTANA (*Clerck*).

Winlaton in an outbuilding (R.S.B.); one immature ♀ by beating gorse at Eddies' Bridge, near Edmundbyers, March, 1913 (R.S.B. & W.L.T.)

LINYPHIA TRIANGULARIS (*Clerck*).

Common.

LINYPHIA PELTATA (*Wid.*)

Common throughout area.

LINYPHIA PUSILLA (*Sund.*)

One young ♀ by beating gorse, Eddies Bridge, March 29th, 1913 (R.S.B. & W.L.T.)

LINYPHIA HORTENSIS (*Sund.*)

Both sexes, Gibside, January, 1906 (R.S.B.)

LINYPHIA INSIGNIS (*Bl.*)

Gibside, Winlaton and Winlaton Mill, December, 1905 (R.S.B.); Axwell Park, Swalwell, August, 1909 and June, 1910 (W.L.T.)

DRAPETISCA SOCIALIS (*Bl.*)

Common everywhere on tree trunks—especially on trees covered with *Cryptococcus viridis*.

STEMONYPHANTES LINEATUS (*L.*)

Common everywhere.

BOLYPHANTES LUTEOLUS (*Bl.*)

Common everywhere.

BOLYPHANTES ALTICEPS (*Sund.*)

Winlaton Mill, ♀, August, 1911 (W.L.T.), and in haystack refuse, Hunstanworth, March, 16th 1913 (R.S.B. & W.L.T.)

TAPINOPA LONGIDENS (*Wid.*)

Common at Winlaton, Axwell Park, and Gib de (R.S.B. & W.L.T.)

SUB-FAMILY II.—TETRAGNATHINÆ.

EUGNATHA STRIATA (*C.L.K.*)

Gibside, spring, 1909, 1 young ♀. A very rare species, previously recorded from Dorset, Norfolk, and Sligo. My example occurred with two other unexpected spiders *Dictyna variabilis* and *Ballus depressus*, in a marshy spot in Gibside West Woods (R.S.B.)

PACHYGNATHA DE GEERII (*Sund.*)

Common, Gibside, Axwell, Winlaton, Hollinside, Hunstanworth and Blanchland (Northd.)

PACHYGNATHA CLERCKII (*Sund.*)

Winlaton, Axwell, Gibside, Hunstanworth, and Blanchland (Northd.) (R.S.B. & W.L.T.)

PACHYGNATHA LISTERII (*Sund.*)

A rare spider. Axwell, March 29th, 1906, and further examples, both sexes, at Winlaton and Gibside in haystack refuse (R.S.B.); in Axwell, haystack, May, 1909, adult male (W.L.T.)

TETRAGNATHA SOLANDRII (*Scop.*)

On long grasses at edge of wood near Winlaton, summer, 1905 (R.S.B.)

TETRAGNATHA EXTENSA (*L.*)

Two young examples taken in long grass in a ditch at edge of moor, Shildon Burn, on March 30th, 1913, are almost certainly referable to this species (W.L.T.)

META SEGMENTATA (*Clerck*).
Common.

META MERIANÆ (*Scop.*)
From moss, rushes, etc., in shady places. Evidently common throughout valley (R.S.B. & W.L.T.)

NESTICUS CELLULANUS (*Clerck*).
In long hanging grass by a waterfall in Gibside, January, 1906, and common in an old well at Winlaton, March, 1907 (R.S.B.)

SUB-FAMILY III.—ARGIOPINÆ.

ZILLA X-NOTATA (*Clerck*).
Common.

ZILLA ATRICA (*Koch*).
Gibside (R.S.B.)

CYCLOSA CONICA (*Pall.*)
Immature male, 1906, Winlaton (R.S.B.); immature males, May, 1909, Axwell (W.L.T.)

EPEIRA CUCURBITINA (*Clerck*).
June, 1906, Gibside (R.S.B.); Shildon Burn, Hunstanworth and Roughside, March, 1 93 (R.S.B. & W.L.T.)

EPEIRA TRIGUTTATA (*Fabr.*)
Hunstanworth, June, 1906 (R.S.B.)

EPEIRA DIADEMATA (*Clerck*).
Numerous.

EPEIRA CORNUTA (*Clerck*).
Winlaton Mill and Blanchland (Northd.) (R.S.B. & W.L.T.)

EPEIRA QUADRATA (*Clerck*).
Blanchland (Northd.), both sexes, September, 1910 (W.L.T.), Gibside, one ♀, August, 1911 (R.S.B.)

EPEIRA UMBRATICA (*Clerck*).
Several examples under bark of rail posts near water, Axwell Park, June, 1906, and under similar conditions at Gibside, January, 1913 (R.S.B.)

ORDER II.—PHALANGIDEA (Harvestmen).

FAMILY PHALANGIIDÆ.

Liobunum rotundum (*Latr.*)
Not uncommon (R.S.B.)

Megabunus insignis (*Meade*).
Rather rare, Gibside, Axwell and Winlaton (R.S.B.)

Platybunus corniger (*Herm.*)
Not uncommon (R.S.B.)

Phalangium opilio (*Linn.*)
Very common (R.S.B.)

Phalangium parietinum (*De Geer*).
Not uncommon, chiefly near buildings (R.S.B.)

Oligolophus morio (*Fabr.*)
Very common (R.S.B.)

Oligolophus alpinus (*Herbst.*)
Common on the higher parts of the valley (R.S.B.)

Oligolophus tridens (*C.L.K.*)
Common (R.S.B.)

Oligolophus palpinalis (*Herbst.*)
Gibside, Ebchester, Hunstanworth and Blanchland (R.S.B.)

Oligolophus agrestis (*Meade*).
Common (R.S.B.)

FAMILY NEMASTOMATIDÆ.

Nemastoma lugubre (*Muller*).
Common throughout area (R.S.B.)

Nemastoma chrysomelas (*Herm*).
Common on the moors as well as in the lower reaches of the valley (R.S.B.)

ORDER III.—CHERNETIDEA (Pseudo-Scorpions).

FAMILY CHERNETIDÆ.

When Dr. Randell Jackson's Tynedale Spiders was published (1906) but one false scorpion, the ubiquitous *Obisium muscorum*, was known from the counties of Northumberland and Durham. We now have six records, of which the following three have occurred in the Derwent Valley. Systematic search should increase this list considerably (R.S.B.)

Obisium muscorum (*Leach*).

Common and widely distributed, occurring on our highest moors and hills, as well as in the woods and pastures of the valley (R.S.B.)

Chthonius tetrachelatus (*Preyss.*)

Under stones and boards, chiefly in gardens, Newcastle, Winlaton and Gibside; one example in bracken refuse, Gibside, April 12th, 1913 (R.S.B.)

Chthonius rayi (*Koch*).

One example from under a stone, Gibside, June, 1910 (R.S.B.)

6.—ORIBATIDÆ. p. 152.

(Beetle-mites)

OF THE COUNTY OF DURHAM, WITH SPECIAL REFERENCE TO THE DERWENT VALLEY.

BY REV. J. E. HULL, M.A.

I submit a preliminary list of Durham Oribatidæ at the request of Mr. R. S. Bagnall, to whom nearly the whole of the records are due. He has been assisted, so far as the Derwent Valley is concerned, by Messrs. W. L. Turner and H. S. Wallace; and I have also had a record or two for the Team Valley from Mr. J. W. H. Harrison. I am indebted to some of the junior members of the Club for a sack of material, which if not very rich in species, was nevertheless very welcome. My own collecting was limited to two or three hours on the Durham coast, for the most part simply duplicating observations already made by Mr. Bagnall.

Of the 69 species here enumerated, eight (marked with an asterisk) have not yet been found in the Derwent Valley.

Those marked † require further study and probably include some new species. *Hermannia fluviatilis*, sp. n., is described at the end.

SUB-FAM. ORIBATINAE.

1.—Gen. PELOPS.

***P. acromius* (Herm.) ... ... Under stones on the sea banks, Ryhope to Hart.

***P. fuligineus* (Koch) ... ... Wet moss, sea banks, Ryhope. both of these and 2 others, are sure to turn up in the Derwent Valley.

2.—Gen. ORIBATES (Latr.).

§i.

O. edwardsii. (Nic.) ... ... Damp moss, anywhere.

O. globulus (Nic.) ... ... Largest and commonest of the genus.

O. gracilis (Mich.) ... ... Ground moss, Gibside.

**O. lapidaria* (Luc.) ...	... Under stones, sea banks, Ryhope.
O. mollicomus (Koch) ...	... Moss, lichen, old wood, Gibside, Hart.
**O. orbicularis* (Koch) ...	... Moss on trees, Hart.
†*O. picipes* (Koch) ...	... On gorse or in dry moss, etc. Ruffside, Eddy's Bridge, near Edmundbyers, Gibside, Fatfield, and Blackhall Rocks.
†*O.* sp. ...	... As preceding, Gibside.

§ii.

O. ovalis (Koch) ...	... In moss everywhere; Gibside, Hart.
O. quadricornutus (Mich.)	... Feeds normally on decaying wood but travels fast and so may be found anywhere. Gibside, Bolt Law (the Bolt Law specimens may be another species).

§iii.

O. cuspidatus (Mich.) ...	... Moss, lichen, etc., anywhere. Chopwell, Gibside, Blanchland (Bolt Law and Edmundbyers), Hart and Ryhope, Shildon Burn (Northd.)
O. dorsalis (Koch) ...	... Two or three specimens from Gibside and Chopwell. In plenty from the seabanks at Ryhope and Blackhall Rocks under stones.
O. lucasii (Nic.) ...	... Old wood, bracken, debris. Gibside, also Shildon Burn near Blanchland (Northd.).
†*O.* sp. ...	... Moss, Gibside and Hart.

§iv.

†*O.* sp. ...	... Sphagnum and wet moss, usually. Gibside, Hart.
O. fusiger (Mich.) ...	... I find this commonly in Sphagnum, but it turned up in moss from a pine-wood, Gibside.
O. avenifer (Mich.) ...	... Gibside, under log.

SUB-FAM. NOTASPIDINAE.

1.—Gen. CEPHEUS.

*C. *tegeocranus* (Herm.)	... Ryhope, Hart, and Fatfield. Usually on wood, but turned up in all kinds of material from Hart. It is singular that this species has not yet been met with in the Derwent Valley.

2.—Gen. TEGEOCRANUS.

T. cepheiformis (Nic.) ...	... Feeds normally on decaying wood but turned up in various material from Gibside, Chopwell and Hart.
T. dentatus (Mich.) ...	... Same habitat. Gibside, Chopwell, Birtley and Fatfield.
T. latus (Koch) ...	... Common, usually on wood. Gibside, Chopwell, and Eddy's Bridge, near Edmundbyers, Fatfield.
T. velatus (Mich.) ...	... Earth moss and moss among heather, Gibside. Also in pine needles.

3.—Gen. CARABODES.

C. elongatus (Mich.) ...	... Abundant on rotten wood, Gibside, Chopwell, Fencehouses and Fatfield.
C. fermoralis (Nic.) ...	... On wood, Gibside, Chopwell. Also like many wood-feeders, in moss on trees.
C. labyrinthicus (Mich.)	... Moss in heather, Gibside. Also among dead leaves, etc.
†*C.* sp. ...	... On lichens, Gibside.
†*C.* sp. ...	... Very abundant on lichen, Gibside; occasionally on wood.
C. marginatus (Mich.) ...	... A few specimens from moss in heather, Gibside, Old wood Chopwell.

4.—Gen. LIACARUS.

L. coracinus (Koch) ...	... Moss, Edmundbyers, Fatfield.
L. ovatus (Koch) ...	... Moss, gorse debris, etc., Edmundbyers, Gibside, Hart. Also Shildon Burn, near Blanchland (Northd.).

5.—Gen. SCUTOVERTEX.

**S. maculatus* (Mich.) ...	... Under stones, Marsden Rock.

6.—Gen. NOTASPIS.

§i.

N. exilis (Nic.) ...	... Moss; Edmundbyers.
N. similis (Mich.) ...	... Moss, Edmundbyers; moss in heather, Gibside; also Shildon Burn near Blanchland (Northd.).
N. tibialis ...	... Wet moss, Ryhope, Moss in heather, Gibside.
†*N.* sp. ...	... Tree moss, Hart, Gibside.

§ii.

N. bipilis (Herm.) ...	... Abundant everywhere.

§iii.

†*N.* sp. ...	... Moss, Greatham, Gibside.
†*N.* sp. ...	... Moss on wall, Gibside.

§iv.

N. lucorum (Koch) ...	... Lichen, etc., Gibside.
N. oblonga (Koch) ...	... Moss on lichen, Gibside, Blackhall Rocks and Hart.

§v.

**N. clavipectinata* (Mich.)	... Moss, Greatham.
N. lanceolata (Mich.) ...	... Moss and sphagnum, Bolt Law, Gibside.
N. splendens (Koch) ...	... Moss, Gibside; sphagnum, Bolt Law; gorse needles, Eddy's Bridge.

N. trigona (Mich.) ...	... Earth moss, Gibside.
†*N.* sp. ...	... Moss, Gibside.
N. longilamellata (Mich.)	... Moss, Gibside.

SUB-FAM. DAMAEINAE.

1.—Gen. Damaeus.

**D. nitens* (Koch) ...	... Rare, Greatham and Fatfield.
D. auritus (Koch) ...	... On wood, under stones, etc., Axwell Park, Gibside, Edmundbyers, Fatfield, Ryhope, Blackhall Rocks, Hart and Greatham.
D. clavipes (Herm) ...	... Gibside, Eddy's Bridge, near Edmundbyers, Hart.
D. geniculatus (Koch) ...	... Greatham, Ryhope, Fencehouses, Gibside, Eddy's Bridge, near Edmundbyers.
D. tecticola (Mich.) ...	... Bracken refuse, Gibside.

SUB-FAM. NOTHRINAE.

1.—Gen. Hermannia.

H. arrecta (Nic.) ...	... On wood, Gibside, one example. Another, Chopwell.
H. bistriata (Nic.) ...	... Semi-aquatic, generally found in wet moss or sphagnum. Bolt Law, Gibside, Ryhope, and Blackhall Rocks.
H. convexa (Koch) ...	... Usually on wood, but I have found it plentifully in all kinds moss, and also among pine-needles. It appears to be singularly uncommon in the Derwent Valley. Gibside, Ryhope, and Hart.
H. fluviatilis, sp. n. ...	... Water-moss, Gibside, 2 or 3 specimens only. Probably amphibious like *N. scabra*. Described herein.

H. nana (Nic.) ... ... Sphagnum, Bolt Law; also Shildon Burn near Blanchland (Northd.).

H. scabra (Koch) ... ... Semi-aquatic. Found in wet moss, Gibside, Ryhope, and Blackhall Rocks. Common under stones, Fencehouses, Penshaw, and Fatfield.

2.—Gen. NOTHRUS.

N. bicarinatus (Koch) ... ... Moss in heather, etc., Gibside, gorse debris, Eddy's Bridge, near Edmundbyers.

N. glaber (Mich.) ... ... Semi-aquatic. Sphagnum on Bolt Law.

N. palustris (Koch) ... ... Normally an inhabitant of damp moss in woods, but found in all kinds of material, from Hart, and on wood, Gibside.

N. segnis (Herm.) ... ... Moss of various kinds, Chopwell, Gibside, also among pine-needles.

N. silvestris (Nic.) ... ... Usually in moss under trees, also in dead leaves and among heather, Gibside.

3.—Gen. HYPOCHTHONIUS.

**H. brevis* (Mich.) ... ... A very minute yellow species; several examples in rotten wood from a quarry near Penshaw.

SUB-FAM. PHTHIRACARINÆ.

1.—Gen. HOPLODERMA.

H. dasypus (Dug.) ... ... Feeds on decaying wood like all the rest of the sub-family, but turns up in all sorts of places. All localities including Bp. Auckland. A form answering to *H. globosum* (Koch) occurred at Gibside, but I do not think it a distinct species.

†*H.* sp. ... ... This resembles a small *H. dasypus* but the pseudostigmatic organ is three times as long and of a different shape, Gibside.

H. magnum (Nic.) ... ... Not so common as *H. dasypus*, but found in all the Derwent Valley localities.

2.—Gen. PHTHIRACARUS.

P. arduus (Koch) ... ... A single example, on wood, Gibside; another later, same locality.

HERMANNIA FLUVIATILIS, sp. n.

Intermediate between *H. convexa* (Koch) and *H. bistriata* (Nic.) but larger than either and of a paler colour, being distinctly brownish above and quite rust-brown beneath. Length circa .9mm.—the largest species of this genus.

There is no definite margin to the dorsum of the abdomen, but the edges are slightly turned up from the shoulder to a short distance beyond the middle. The surface is irregularly pitted, more closely than in *bistriata*, less so than in *convexa*. The dorsal setae have the same arrangement as in *convexa*, but are filiform, acute, adpressed, and so long as to overlap one another. *No setae on the posterior margin different from the rest*, except in being shorter and more curved. The abdomen is somewhat pointed behind.

Cephalothorax finely and closely pitted. Pseudostigmatic setae rod-like, but slightly clavate and pointed. Legs as of *bistriata*, but the thicker hairs are all longer and acute.

Readily distinguishable from *convexa* by the longer and thinner dorsal setae, shorter pseudostigmatic organs, and the partially marginate dorsum of the abdomen; and from *bistriata* by the regularly arched and oval abdomen; from both by the total absence of spatulate setae.

Two specimens: Gibside, moss in stream, April, 1913. (R.S.B.).

Report of the Hope Professor of Zoology, 1913, 1914.

The Reports of the Hope Department written by the present Professor up to and including the year 1912 have been presented to the Delegates of the University Museum and by them submitted to Convocation and brought before the University in the pages of the *Gazette*. The activity of a recently-elected Delegate led, on June 3, 1913, to the appointment of a Committee "to consider the question of the form and contents of these Departmental Reports . . ." Although, as regards the necessity for a long and elaborate report, the Hope Department is in a very different position from all the other Museum Departments except the Pitt-Rivers Museum, the Professor was not invited to any of the deliberations of the Committee. Nor was any opportunity afforded for a full consideration of the Committee's report, which, dated Oct. 22, 1913, was put down for discussion and adoption at the Delegates' Stated Meeting on Oct. 25. At this meeting therefore the Professor was given his first chance of criticising a completed scheme which affected him far more seriously than any other Departmental head. It was a meeting entirely unsuited for the discussion of detail. Seventeen persons were present with 14 items on the agenda, the Committee's Report being only the second on the list. It was of course quite impossible to verify any statements. Thus the Professor said he was confident that his reports had not increased in length during recent years, but that, except for 1912, with special causes in operation, they had on the whole diminished. With this conclusion the promoter of the Committee signified his disagreement. There was no time to get the facts and the Delegates voted without knowing them. Yet the Professor's conclusions were correct, for the five reports from 1903 to 1907 averaged 50 octavo pages, the five from 1908 to 1912 only 40 pages, each.

The above may serve as a sample of a discussion that from the first was bound to be futile, and the Delegates,

adopting a custom that is happily rare in this country, condemned the Professor's method without allowing him an effective hearing. To his profound discouragement the Professor has been led to feel that the Delegates have ended a friendly and pleasant association which had endured for twenty years.

1. *The Assistant Curator of the Hope Collections.*

At the end of 1913 Mr. R. S. Bagnall was compelled by pressing business engagements to leave Oxford for a time, and, when the war broke out, he found it impossible to return. In the period of financial stress which then began the Professor did not ask for the appointment of a successor, so that the stipend of the Assistant Curator has become available.

2. *Work done by the Staff.*

On Nov. 15, 1913, Mr. H. Britten was appointed as an assistant, and his great experience with obscure and difficult groups of British insects has proved to be of great value to the Department.

In addition to the large amount of work, implied by the list of accessions in 1913 and 1914, which has fallen upon Mr. A. H. Hamm, Mr. Joseph Collins and Mr. H. Britten, a great deal of time and skill has been expended upon the older parts of the Hope Collections, especially the Coleoptera. It is hoped that gradual progress will continue to be made with the vast accumulation of valuable material.

3. *Work on the Collection of Pierinae.*

During the two years 1913 and 1914 Dr. F. A. Dixey continued his work on the collection of *Pierinae*. He incorporated specimens from the donations of Sir G. Kenrick, Commander J. J. Walker, Dr. G. B. Longstaff, Rev. K. St. A. Rogers, Messrs. C. A. Foster, G. F. Leigh, H. H. Druce, F. C. Woodforde, C. M. Dammers, J. J. Joicey, R. A. Craig, V. G. Bell, R. Evans, D. Watson, R. E. Kunzé, H. Grose Smith, J. C. Moulton, C. Oberthür,

E. R. Speyer, W. Schaus, H. B. Popplewell and Miss D. Wilson. The number of specimens thus added to the collection, many of which were of species previously unrepresented there, was 1087. He worked out series of Pierines sent by Dr. G. D. H. Carpenter from Uganda, by Mr. G. F. Leigh from the Comoro Islands, and by Mr. C. A. Willis from the Nuba Hills west of the White Nile. The following short papers were contributed by him to the Proceedings of the Entom. Soc. Lond.: (1) "On *Tatochila immaculata*", (2) "Mimicry in relation to Geographical Distribution", (3) "Pierids and their scent-scales", (4) "Pierines from Western China". Papers were read by Dr. Dixey at the British Association Meetings at Birmingham and Sydney; on "Geographical Distribution and Mimicry" and on "The Scent-distributing apparatus in certain Papilionines, Pierines and Erycinids," respectively. A paper in which six new species and subspecies of *Pierinae* were described and figured was communicated to the Entom. Soc. Lond., and will be published in a forthcoming volume of the Society's Transactions.

4. *Rearrangement of the British Beetles.*

The remounting and rearrangement of the Hope-Westwood collection of Coleoptera (British) has been continued at intervals during the years 1913 and 1914 by Commander J. J. Walker, who has kindly written the following report: "The insects dealt with in 1913 belong mostly to the smaller and more obscure families of the Clavicorn series, and, as was the case with the *Staphylinidae*, a good many of the specimens, owing to their antiquity, as well as to the practice of the older Coleopterists of pinning nearly every specimen, however minute, have presented much difficulty in successful manipulation. One or two outstanding groups of the series, of which the *Nitidulidae* are the most important, still remain to be taken in hand. Mr. Donisthorpe's excellent specimens have been suitably remounted at the same time.

"Further progress has been made with this collection

during the year 1914, and the remounting, &c., is now practically completed as far as the end of the family *Elateridae*. The large and important group of the Brachelytra is now being 'assembled' and the species put into proper sequence, while the numerous specimens from the 'Tylden' and 'Chitty' collections, as well as many species received from Messrs. H. St. J. Donisthorpe, W. Holland, W. E. Sharp and other donors, are being incorporated with those from the Hope-Westwood collection, the whole forming an excellent representative series of these very interesting Coleoptera."

5. *Work on the British Collections of Macro-Lepidoptera.*

For some years Mr. F. C. Woodforde, B.A., Exeter, has given the most generous assistance to this important section of the Hope Department, residing in Oxford and undertaking the rearrangement of the specimens during the winter months, collecting and breeding in various rich localities during the rest of the year. Furthermore, the same generous helper has brought the needs of the Department before many of his friends, who have presented the numerous valuable accessions acknowledged in the later pages of this report. The rearrangement was completed in the early part of 1915, although it is much to be hoped that Mr. Woodforde may be able to continue to visit Oxford and help in the incorporation of fresh material.

The present condition of the Oxford collection of British Macro-Lepidoptera is described as follows by Commander J. J. Walker, Hon. M.A.:—

The rearrangement of the *Macro-Lepidoptera* of this important collection was in 1913 kindly undertaken by Mr. F. C. Woodforde, F.E.S., who has now brought his task to a conclusion. The original "Hope-Westwood" collection, augmented more than twenty years ago by the Rev. F. M. Spilsbury's large collection of British *Lepidoptera*, includes fine series of several of our rare and extinct species, those of *Chrysophanus dispar* (now numbering 23 specimens), *Nomiades semiargus*, and *Noctua subrosea* being specially noteworthy, besides many specimens of historic interest and some good varieties. The work of rearrangement has become highly desirable by the gift of a large number of specimens of rare and local species by several

of our prominent Lepidopterists, and by the presentation to the Museum in recent years of the fine collections made by the late Messrs. A. J. Chitty and H. S. Sellon. All these have now been incorporated; the insects have been "staged" where necessary to an uniform height, and special care has been taken to indicate by distinctive labelling the source of every specimen so far as it can be ascertained. The *Macro-Lepidoptera* now occupy 250 cabinet drawers, of which 48 are appropriated to the butterflies alone. The *Pyrales*, *Pterophori*, *Tortrices*, and *Tineae*, which in 1905 were enriched by the very fine collection of these insects generously presented by Mrs. E. C. Bazett, are contained in about 100 more drawers, and have also been recently arranged by the Museum staff. The entire series of British *Lepidoptera* in the Oxford University Museum, including the historic "Dale" cabinets (*cf.* Ent. Mo. Mag., 1907, pp. 93, 130, 154; 1909, pp. 106, 179), now forms one of the finest reference collections in existence, and is readily accessible to all students of the Order. (Ent. Mo. Mag., Mch., 1915, p. 126.)

6. *The Visit of the British Association to Australia.*

Dr. Dixey and the Professor took part in this expedition and were able to bring back large numbers of specimens for the Department. Furthermore Australian naturalists in correspondence with the Professor are undertaking observations, some of which have already led to very interesting results.

7. *Visits of Naturalists, and assistance in working out the material of the Department.*

The annual gathering of entomologists took place in 1913 but was prevented in the following year by the Australian meeting of the British Association. The following Officers and Members of the Council of the Entomological Society were present July 5—7, 1913:—Rev. F. D. Morice, *President*: Commander J. J. Walker and Rev. G. Wheeler, *Secretaries*; G. C. Champion, Dr. F. A. Dixey, F.R.S., J. H. Durrant, Dr. H. Eltringham, A. E. Gibbs, G. A. K. Marshall, W. E. Sharp, and C. J. Wainwright. R. S. Bagnall and W. Borrer were also present. A visit to Boar's Hill was arranged for the afternoon of July 6, when the party was kindly entertained at Youlbury

by Sir Arthur Evans, F.R.S. The visit was, as usual, of great benefit to the Department.

The collections were also visited on other occasions during 1913 by the following kind friends:—Mrs. Addison, Sierra Leone; A. Avinoff, Petrograd; Miss Balfour; P. A. Buxton, Trinity College, Cambridge; W. C. Crawley; L. Doncaster, F.R.S.; H. St. J. K. Donisthorpe; Rev. Canon W. W. Fowler; J. A. de Gaye, King's College, Lagos; A. E. Gibbs; F. W. J. Jackson; W. J. Kaye; Ven. Archdeacon G. K. Kestell-Cornish, Ambinanindrano, Madagascar; Guy A. K. Marshall; Prof. R. Meldola, F.R.S.; W. J. von Monté-Pendlebury, Rev. Lake S. Noble, Lagos, S. Nigeria; E. E. Platt, Durban; Prof. R. C. Punnett, F.R.S.; Rev. K. St. Aubyn Rogers, Sagalla, Brit. E. Africa; Hugh Scott, Trinity College, Cambridge; W. E. Sharp; Miss Agnes W. Thomson; R. T. Turley, Mukden, Manchuria; C. B. Williams; Miss Diana R. Wilson (Mrs. Fyson); H. I. A. Wimberley, Warri, S. Nigeria.

Before his return to Uganda Dr. G. D. H. Carpenter did a great deal of work in the Department, preparing his paper read before the Birmingham meeting of the British Association, and his three papers in the Trans. Ent. Soc., 1913. Prof. J. F. van Bemmelen of Groningen studied the patterns of Lepidoptera, Sept. 18—22, and has since published a memoir on the subject.

The Department was also visited in 1913 by:—The King of Uganda; Sir James Caird; Dr. H. T. Fernald, Amherst, Mass.; Dr. H. Gadow, F.R.S.; Willoughby Gardner; the late Dr. W. H. Gaskell, F.R.S.; Baron de Haulleville, Director of the Congo Museum, Brussels; Prof. S. J. Hickson, F.R.S.; Prof. S. Ichikawa, Tokyo; Dr. David Starr Jordan; Dr. Norman H. Joy; Sir Ray Lankester, F.R.S.; Alleyne Leechman, Georgetown, Brit. Guiana; J. J. Lister, F.R.S.; F. N. Pierce; W. L. Tower, Chicago; Prof. R. Ramsay Wright.

In 1914 the visitors to the Department were greatly reduced in consequence of the War and the absence of the Professor for the meeting of the British Association

in Australia. The collections were nevertheless visited by several naturalists, some of whom remained in Oxford for a considerable time in order to study them.

Col. J. W. Yerbury very kindly came to reside in Oxford from Feb. 28 till March 18 in order to continue his generous help with the collections of Diptera. He incorporated large numbers of *Asilidae* from the Bigot collection presented by J. E. Collin, and worked out a large series of the same flies collected with their prey at Chirinda, S.E. Rhodesia, by C. F. M. Swynnerton.

Dr. R. Hanitsch, Curator of the Raffles Museum, Singapore, studied the *Blattidae* daily for many weeks, and was enabled to determine numbers of Eastern species by comparison with the collection worked out and arranged by the late R. Shelford.

For some weeks before sailing for Australia on June 22, the Professor worked with C. A. Wiggins upon the great collection made and presented to the University by this generous donor and indefatigable naturalist; and, but for the long anticipated meeting of the British Association they would probably have completed their joint memoir on mimicry in the forest butterflies of Uganda.

The same cause prevented the Professor from meeting another generous donor, W. A. Lamborn, who paid many visits to the Department in the summer in order to study his fine collection recently made at Moor Plantation, near Ibadan, S. Nigeria, and to prepare for publication his record of observations on the Hymenoptera in this locality.

In addition to other short visits C. F. M. Swynnerton, another kind helper with African material, lived in Oxford for nearly a month, towards the end of 1914, in order to study his immense mass of material from Chirinda, in the preparation of an important memoir on insect bionomics.

In addition to the above, the following friends came to see the collections or to work upon them:—The Rev. J. W. B. Bell; G. C. Champion; L. Doncaster; C. O.

Farquharson; F. W. J. Jackson; Dr. F. W. Jackson; the Ven. Archdeacon G. K. Kestell-Cornish; G. A. K. Marshall; S. A. Neave; M. A. Pallis; J. W. Peed; Dr. R. C. L. Perkins; L. B. Prout; H. Rowland-Brown; Miss Agnes W. Thomson.

The Department was also visited in 1914 by:—Prof. S. J. Hickson; Dr. Norman H. Joy; Dr. J. P. Lotsy, Haarlem; Hon. Paul A. Methuen; Dr. Marett Tims.

8. *Eighth with Appendix, and Ninth Volumes of Hope Reports.*

Two of these volumes, VIII. and IX., were the result of three years' accumulated separata—49 in number. The third, issued as an Appendix to VIII., contains nine large octavo memoirs which appeared gradually over a number of years, one having been published as far back as 1890. Ten memoirs specially concerned with the African Insect fauna make up Vol. IX., while 39 in Vol. VIII. and 9 in its Appendix deal with Insects from various parts of the world. All three volumes were issued together in 1913, the Prefaces being dated July 21.

Sufficient material has accumulated since July, 1913, to make up another volume (X.) and probably sufficient to complete an Appendix, containing small quarto memoirs published from time to time over a much longer period.

9. *Works published in* 1913 *and* 1914.

The papers in the following list are grouped according to subject. Five of them appeared in the early part of 1913 and have already been issued in Hope Reports—four, marked *, in Vol. VIII., one, marked **, in Vol. IX.

The forthcoming Vol. X. will, it is hoped, contain nearly all the remaining papers with the following arrangement. It is possible however that such a volume will be too bulky and that some regrouping may be necessary.

A Remarkable American Work upon Evolution and the Germ Theory of Disease, the Presidential Addresses delivered at the Anniversary Meetings

of the Linnean Society of London, May 24, 1913, and May 25, 1914, by the Professor. With an Appendix containing a reprint of G. W. Sleeper's booklet dated 1849. (From Proc. Linn. Soc. Lond., 1912-13, p. 26, and 1913-14, p. 23.)

The term 'Mutation', by the Professor. (From Report, Brit. Assoc., Birmingham, 1913, p. 519.)

Mimicry, by the Professor. (From Report, Brit. Assoc., Birmingham, 1913, p. 518.)

Mimicry between the Genera of certain African Nymphaline Butterflies, by the Professor. (From Report, Brit. Assoc., Birmingham, 1913, p. 519.)

*Mimicry, Mutation and Mendelism, by the Professor. (From Bedrock, Apr., 1913, p. 42.)

Mimicry and the Inheritance of Small Variations, by the Professor. (From Bedrock, Oct., 1913, p. 295.)

The Evolution of Mimetic Resemblance, by the Professor. (From Bedrock, Apr., 1914, p. 34.)

The inheritance of small variations in the pattern of *Papilio dardanus*, Brown, by Dr. G. D. Hale Carpenter. (From Trans. Ent. Soc. Lond., 1913, p. 656.)

The Geographical Relations of Mimicry, by Dr. F. A. Dixey. (From Report Brit. Assoc., Birmingham, 1913, p. 518.)

Pseudacraeas aud their Acraeine Models on Bugalla Island, Sesse, Lake Victoria, by Dr. G. D. H. Carpenter. (From Report Brit. Assoc. Birmingham, 1913, p. 517.)

Pseudacraea eurytus hobleyi, Neave, its forms and its models on Bugalla Island, Lake Victoria, by Dr. G. D. Hale Carpenter. (From Trans. Ent. Soc. Lond.. 1913, p. 606.)

Pseudacraea boisduvali, Doubl., and its models, with especial reference to Bugalla Island, by Dr. G. D. Hale Carpenter. (From. Trans. Ent. Soc. Lond., 1913, p. 646.)

On the Urticating Properties of *Porthesia similis*, Fuess., by H. Eltringham, D.Sc. (From Trans. Ent. Soc. Lond, 1913, p. 423.)

Field Observations on the Enemies of Butterflies in Ceylon, by J. C. F. Fryer, M.A., Fellow of Gonville and Caius College, Cambridge. (From Proc. Zool. Soc. Lond., 1913, p. 613.)

The Enemies of 'Protected' Insects; with special reference to *Acraea zetes*, by Dr. G. D. H. Carpenter. (From Report, Brit. Assoc., Birmingham, 1913, p. 516.)

On the Scent Apparatus in the male of *Amauris niavius*, Linn., by H. Eltringham, F.Z.S. (From Trans. Ent. Soc. Lond., 1913, p. 399.)

Further notes on scents in Butterflies, by Dr. G. B. Longstaff. (From Ent. Month. Mag., 1914, p. 1.)

Mr. W. A. Lamborn's Observation on Marriage by Capture by a West African Wasp. A possible explanation of the great variability of certain secondary sexual characters in males, by the Professor. (From Report, Brit. Assoc., Birmingham, 1913, p. 511.)

Empidae and their Prey in relation to Courtship, by A. H. Hamm. (From Ent. Month. Mag., 1913, p. 177.)

On the Relationship between certain West African Insects, especially Ants, *Lycaenidae* and *Homoptera*, by W. A. Lamborn, M.R.C.S., L.R.C.P., F.E.S., Entomologist to the Agricultural Department of Southern Nigeria. With an Appendix containing Descriptions of New Species, etc., by G. T. Bethune-Baker, Pres. Ent. Soc., W. L. Distant, Harry Eltringham, Prof. E. B. Poulton, J. Hartley Durrant, and Prof. Newstead, F.R.S. (From Trans. Ent. Soc. Lond., 1913, p. 436.)

**The Butterflies of the White Nile: a Study in Geographical Distribution, by Dr. G. B. Long-

staff. (From Trans. Ent. Soc. Lond., 1913, p. 11.)

The Geographical Distribution of *Danaida plexippus* L. (*Danais archippus*, F.) with especial reference to its recent migrations, by J. J. Walker. (From Ent. Month. Mag., 1914, pp. 181-193, 224-237.)

Description of a new Species of *Pseudonympha* (*Satyrinae*) from South Africa, by Roland Trimen, Hon. M.A., F.R.S. (From Ent. Month. Mag., 1914, p. 281.)

On new or little-known forms of *Acraea*, by H. Eltringham; with description of a new form of *Acraea encedon*, by the Professor. (From Trans. Ent. Soc. Lond., 1913, p. 407.)

Descriptions of new Species of African Heterocera in the Oxford Museum, by G. T. Bethune-Baker, F.L.S. (From Ann. Mag. Nat. Hist., 1913, p. 62.)

Fourth Supplement to the Preliminary List of the Coleoptera of the Oxford district, by J. J. Walker. (From Report Ashmol. Nat. Hist. Soc. of Oxfordshire, 1914, pp. 62-68.)

Note sur *Lucanides* conservés dans les collections de l'Université d'Oxford et du British Museum, par M. H. Boileau, F.E.S. (From Trans. Ent. Soc. Lond., 1913, p. 213.)

On the Hymenopterous genera *Trichogramma*, Westw., and *Pentarthron*, Riley, by Dr. R. C. L. Perkins, D.Sc. (From Trans. Ent. Soc. Lond., 1913, p. 603.)

A Chalcid Parasite on *Thrips* (Thysanoptera), by R. S. Bagnall. (From Report Brit. Assoc. Birmingham, 1913, p. 531.)

Algunos Neurópteros del Museo de Oxford, por el R. P. Longinos Navás, S. J. (From Bol. de la Soc. Aragon. de Cienc. Nat., Mar., 1914, p. 61.)

Brief Descriptions of new Thysanoptera.—I., by R. S. Bagnall. (From Ann. Mag. Nat. Hist., 1913, p. 290.)

Ditto.—II. (Ibid, 1914, p. 22.)
Ditto.—III. (Ibid, 1914, p. 287.)
Ditto.—IV. (Ibid, 1914, p. 375.)

Fossil Insect in Amber. On *Stenurothrips succineus*, gen. et sp. nov., an interesting Tertiary Thysanopteron, by R. S. Bagnall. (From Geol. Mag., 1914, p. 483.)

On a new species of *Melanothrips* (Thysanoptera) from Tunisia, by R. S. Bagnall. (From Ent. Month. Mag., 1913, p. 263.)

*Notes on some rare Thrips (Thysanoptera) from Scotland, by R. S. Bagnall. (From Scottish Naturalist, 1913, p. 37.)

Descriptions of some new species of British Thysanoptera (Tubulifera), by R. S. Bagnall. (From Ent. Month. Mag., 1913, p. 264.)

Conclusion of above. (From Ent. Month. Mag., 1914, p. 35.)

Some interesting British Insects, by F. W. L. Sladen, R. S. Bagnall, and J. E. Collin. (From Ent. Month. Mag., 1913, p. 171.)

On two species of *Haplothrips* new to the British Fauna, by R. S. Bagnall. (From Ent. Month. Mag., 1913, p. 227.)

Euthrips tamicola, a new species of Thysanoptera from the flowers of the Black Bryony, by R. S. Bagnall. (From Ent. Month. Mag., 1914, p. 273.)

Review of Field Work in 1911, by R. S. Bagnall. (From Ent. Record, 1913, p. 224.)

On the Systematic Position of the Order Protura, by R. S. Bagnall. (From Report Brit. Assoc. Birmingham, 1913, p. 531.)

*Notes towards a Knowledge of the Clyde Myriapoda, by R. S. Bagnall. (From Glasgow Naturalist, 1913, p. 89.)

Lithobius duboscqui, Brölemann, a Centipede new to the British Fauna, by R. S. Bagnall. (From Zoologist, 1913, p. 292.)

The Scottish Symphyla, by R. S. Bagnall. (From Scottish Naturalist, 1913, p. 182.)

*Records of two rare Woodlice from the Forth area, by R. S. Bagnall. (From Scottish Naturalist, 1913, p. 39.)

The Woodlice (Terrestrial Isopoda) of Northumberland and Durham, with Keys to the Genera and Species, by R. S. Bagnall. (From Vale of Derwent's Naturalist's Field Club Trans., 1913, p. 94.)

Extracts from the 'Proceedings of the Entomological Society of London', Feb.—Dec., 1913, containing the following communications:—

a. Feb. 5, 1913.—1. Cocoons of moths from the Lagos district, by W. A. Lamborn. (p. v.)

2. Sexes of Gonometa subfascia, Walker, by J. A. de Gaye, F.L.S. (p. vii.)

3. Papilio dardanus, Brown, female form leighi, by the Professor. (p. vii.)

4. Further synepigonic Pseudacraeas of the eurytus, L., group, bred on Bugalla, in the Sesse Archipelago, by Dr. G. D. H. Carpenter. (p. viii.)

5. "*Trichogramma*, Westw., probably synonymous with *Pentarthron*, Riley (Hymenoptera)," by Dr. R. C. L. Perkins, read. (p. xii.)

b. March 5, 1913.—1. A collection of Larentia citrata, L. (immanata, Haw.) from Iceland, by L. B. Prout. (p. xvi.)

2. Disabling and other injuries found in Lepidoptera and their interpretation, by the Professor. (p. xix.)

3. The sluggishness of the African Lycaenid butterfly Megalopalpus zymna, D. and H., by W. A. Lamborn. (p. xxii.)

c. March 19, 1913.—1. "On the Scent-apparatus of *Amauris niavius*, L.," by H. Eltringham, read. (p. xxiv.)

d. May 7, 1913.—1. Scales of Cnethocampa pityocampa, Schiff, by H. Eltringham. (p. xxxi.)

9. "Supplementary notes on new or little-known forms of Acraea" by H. Eltringham, read. (p. lvii.)

f. Oct. 1, 1913.—1. Haplothorax burchellii, from St. Helena in 1913, by H. F. Bartlett. (p. lviii.)

2. Mimicry in relation to Geographical Distribution, by Dr. F. A. Dixey. (p. lx.)

3. Papilio dardanus, Brown, bred in S.E. Rhodesia, by C. F. M. Swynnerton. (p. lxix.)

4. An imported American Syntomid moth, by Commander J. J. Walker. (p. lxx.)

5. "On the Urticating Properties of Porthesia similis," by H. Eltringham, read. (p. lxxiii.)

g. Oct. 15, 1913.—1. Butterflies from the Sudan, by Dr. G. B. Longstaff. (p. lxxx.)

2. The male Amauris egialea stroking the brands of the hind-wings with its anal tufts, again observed, by W. A. Lamborn. (p. lxxxiii.)

3. Observations on the courtship of a S. Nigerian Lycid beetle, by W. A. Lamborn. (p. lxxxiv.)

4. A lizard attacking Magachile cincta, F., by W. A. Lamborn. (p. lxxxv.)

5. Insects bred from the nests of Hymenoptera Aculeata, by W. A. Lamborn. (p. lxxxv.)

h. Nov. 5, 1913.—1. Thais rumina as a Protected Species, by Dr. G. B. Longstaff. (p. lxxxvii.)

2. An additional observation on the courtship of a S. Nigerian Lycid beetle, by W. A. Lamborn. (p. lxxxviii.)

3. The importance of preserving insects found in coitû, by Dr. G. D. H. Carpenter. (p. lxxxviii.)

4. Observations on various Insects, mostly from Africa, by Dr. G. D. H. Carpenter. (p. xciv.)

5. Abstracts of three papers by Dr. G. D. H. Carpenter "*Pseudacraea eurytus hobleyi*, Neave, &c.", "*Pseudacraea boisduvali*, Doubl., &c." and "The inheritance of small variations in the pattern of *Papilio dardanus*, Brown." (p. ciii.)

i. Nov. 19, 1913.—1. An abnormal pairing between Pierine butterflies of different genera, by E. E. Green. (p. cv.)

2. Pierids and their Scent-scales, by Dr. F. A. Dixey. (p. cx.)

j. Dec. 3, 1913.—1. Mimicry among Swallowtails, and other notes on butterflies at S. Paulo, Brazil, by Miss Diana R. Wilson (Mrs. Fyson). (p. cxix.)

2. Erotylid beetles found in clay cells in S. Nigeria, by C. O. Farquharson, B. Sc. (p. cxxii.)

3. Observations on the Driver ants (Dorylus) of S. Nigeria, by W. A. Lamborn. (p. cxxiii.)

4. Scent apparatus of the male Amauris egialea, by Dr. H. Eltringham, D. Sc. (p. cxxxiii.)

Extracts from the "Proceedings of the Entomological Society of London", Feb.—Dec., 1914, containing the following communications:—

a. Feb. 4, 1914.—1. A collection illustrating the natural history of certain Algerian Diptera, by Dr. Adalbert Seitz. (p. ii.)

2. Further notes on the Driver ants of S. Nigeria, by W. A. Lamborn. (p. v.)

3. The Pierine butterfly Neophasia terlooti, Behr., female, a new N. American mimic of Danaida plexippus, L. (archippus, F.), by the Professor. (p. viii.)

b. March 4, 1914.—1. Suggested protective value of the Cocoon of Lyonetia clerkella, L., by Dr. F. A. Dixey. (p. xv.)

2. A surprising family of Hypolimnas (Euralia) dubia, Beauv., and anthedon, Dbl., from Natal, by E. E. Platt. (p. xvii.)

c. March 18, 1914.—1. Erotylid beetles occupying the clay cells of Aculeate Hymenoptera, by C. O. Farquharson. (p. xxiii.)

2. Ants attendant on the larvae of the Lycaenid—Myrina silenus, F., in S. Nigeria, by C. O. Farquharson. (p. xxiii.)

3. The misleading resemblance between mimetic butterflies and their models, by the Professor. (p. xxiv.)
4. Some details in the relationship between the mimetic and the non-mimetic patterns of Papilio polytes, L., by the Professor. (p. xxv.)
5. The feeding of captive butterflies, by C. F. M. Swynnerton. (p. xxvi.)
6. Note on the larvae of Anaphe panda, Boisd., by C. F. M. Swynnerton. (p. xxx.)

d. Apr. 1, 1914.—1. Pierines from Western China, by Dr. F. A. Dixey. (p. xxxii.)

e. May 6, 1914.—1. Papilionid scent-scales, by Dr. F. A. Dixey. (p. xxxvi.)
2. Tipulid larvae brought to the surface, probably by continued rains, by the Professor. (p. xxxvi.)
3. The resting position of the African Nymphaline butterfly Hamanumida daedalus, F., by W. A. Lamborn. (p. xxxvii.)
4. The habits of the wasp Belenogaster junceus, F., and the attacks of Tachinid flies upon it, in S. Nigeria, by W. A. Lamborn. (p. xxxix.)
5. Observations on the method by which Tachinid flies escape from the mud cells of Eumenes, by W. A. Lamborn. (p. xli.)
6. The growth of fungi on the shelters built over Coccidae by Cremastogaster ants in S. Nigeria, by C. O. Farquharson. (xlii.)
7. The larvae of two species of the Geometrid genus Aletis in the Lagos District, by W. A. Lamborn. (p. l.)
8. Observations in the islands in the N.W. of the Victoria Nyanza, by G. D. H. Carpenter. (p. li.)
9. "New species and subspecies of Pierinae," by Dr. F. A. Dixey, read. (p. lvi.)

f. June 3, 1914.—1. Families reared from the eggs laid by known females of Papilio dardanus.

h. Dec. 2, 1914.—1. A movable microscopic stage, by Dr. H. Eltringham. (p. cvi.)

2. An Australian Lycaenid larva resembling the flower of the "Wattle", on which it feeds, by the Professor. (p. cvi.)

3. Observations on Dorylus nigricans Illig., in Damba and Bugalla Islands, by Dr. G. D. H. Carpenter. (p. cvii.)

4. Observation of the epigamic use of its anal brushes by the male Amauris psyttalea, Plötz, in Kome Island, N.W. Victoria Nyanza, by Dr. G. D. H. Carpenter. (p. cxi.)

5. "Further Observations on the Structure of the Scent-organs in certain Brush-bearing Male Butterflies," by Dr. H. Eltringham, read. (p. cxii.)

The following papers, also published in the years 1913 and 1914, are of large octavo or quarto size and therefore cannot be included in one of the regular volumes of Hope Reports. Added to memoirs of similar sizes published in earlier years they will be issued as an Appendix to Vol. X. Miss Foot and Miss Strobell have kindly permitted the inclusion of their important memoir towards which Dr. Eltringham contributed a valuable piece of work carried out in the Hope Department. Mr. C. B. Williams has kindly presented the types of the new Thysanoptera described in his two memoirs.

President's Introductory and Final Addresses to the Second Entomological Congress, Oxford, 1912, by the Professor. (From Trans. Second Ent. Congr., 1912, pp. 19, 125, and 129.)

Mimicry in North American Butterflies: A Reply, by the Professor. (From Proc. Acad. Nat. Sci. Phila., 1914, p. 161.)

Pellets ejected by Insect-eating Birds after a meal of Butterflies, by C. F. M. Swynnerton. (From Trans. Second Ent. Congr., 1912, p. 351.)

On the scent-patches of the *Pierinae*, by Dr. F. A. Dixey. (From Trans. Second Ent. Congr., 1912, p. 336.)

W. A. Lamborn's Breeding Experiments upon *Acraea encedon* (Linn.), in the Lagos district of West Africa, 1910—1912, by the Professor. (From Linn. Soc. Lond. Journ.—Zool., 1914, p. 391.)

Results of Crossing *Euschistus variolarius* and *Euschistus servus* with reference to the Inheritance of an Exclusively Male Character, by Katharine Foot and E. C. Strobell. (From Linn. Soc. Lond. Journ.—Zool., 1914, p. 337.)

Thysanoptera of the Abor Expedition, by R. S. Bagnall. (From Records of the Indian Museum, Vol. VIII., Pt. III., No. 13, 1913, p. 201.)

On two new Species of Thysanoptera from the West Indies, by C. B. Williams, B.A., John Innes Horticultural Inst., Merton, Surrey. (From Journ. Econ. Biol., 1913, p. 209.)

A Synopsis of the Thysanopterous Family *Aeolothripidae*, by R. S. Bagnall. (From Trans. Second Ent. Congr., 1912, p. 394.)

Notes on *Aeolothripidae*, with Description of a new Species, by R. S. Bagnall. (From Journ. Econ. Biol., 1913, p. 155.)

Records and Descriptions of British Thysanoptera, by C. B. Williams. (From Journ. Econ. Biol., 1913, p. 216.)

Further notes on new and rare British Thysanoptera (Terebrantia) with Descriptions of New Species, by R. S. Bagnall. (From Journ. Econ. Biol., 1913, p. 231.)

Ceratothrips britteni, n. sp., a type of Thysanoptera new to the British Fauna, by R. S. Bagnall. (From Journ. Econ. Biol., 1914, p. 1.)

The British Species of the Genus *Tetracanthella* (Collembola), by R. S. Bagnall. (From Journ. Econ. Biol., 1914, p. 5.)

On the Classification of the Order Symphyla, by R. S. Bagnall. (From Linn. Soc. Lond. Journ. —Zool., 1913, p. 195.)

Additions to the Collections.

The form of the following pages differs in some respects from that adopted in previous Reports, the changes being in the direction of greater simplicity and brevity. In these alterations the Professor has been greatly helped by the kind advice of Dr. G. B. Longstaff.

Unless otherwise stated in the following account of additions to the collections 1901—1914, it may be assumed that the captures were effected in the year of presentation and that the donor was the captor.

Additions to the Collections in 1901.

One hundred and twenty-three insects, chiefly Hymenoptera Aculeata, Denmark, N.E. Zeeland; 1 beetle, Helsingborg, Sweden——the Professor.

Nineteen insects taken at the same time and the former locality——E. P. Poulton, M.A., D.M., Balliol.

Eighteen insects, chiefly Coleoptera, Heligoland and the neighbouring Düne I., together with 30 Hymenoptera Parasitica of 2 species, with their cocoons, and the Lepidopterous larva, Heligoland, from which they emerged——the Professor.

Two Coleoptera, Düne Island——E. P. Poulton.

A long series of a very common Acridian (grasshopper) captured on Heligoland and the Düne I.——the Professor and E. P. Poulton. All specimens from the former are dark reddish brown like the soil of the flat top of Heligoland, those from the latter either sand-coloured or green, thus resembling the only surface features of the Düne. This colour harmony, to which there were no exceptions, renders it probable that the species is sensitive to some stimulus supplied by the tints of its natural environments. A brief account of these specimens is published in "Essays on Evolution," Oxford, 1908, p. 307.

Seventeen butterflies from Ospedaletti, near San Remo (April)——Hugh Richardson.

Sixty-nine insects of various orders and 4 spiders from the neighbourhood of Funchal, Madeira——H. B. Gray, of the Linacre Department. Also 7 *Eristalis tenax* and 7 examples of its model *Apis mellifica* taken together on the Pico da Cruz near Funchal.

Additions to the Collections in 1905.

The following collections of Malayan insects (of many orders), presented by the late R. Shelford, M.A., Emmanuel College, Cambridge, have only recently been incorporated although they have been pinned and labelled for a long time:—143 from the Buitenzorg Botanical Gardens, W. Java; 146—Menado, Macassar, and Gorontalo, Celebes; 14—Ternate; 11—Bochling, Bali; 16—Ampenan, Lombok.

Additions to the Collections in 1906.

Twenty-seven insects of various groups and 1 Arachnid, captured by S. S. Flower near Roseires, Blue Nile——the Egyptian Government Zoological Gardens.

Sixty-one butterflies of various sub-families, Moa I., South-West Islands, N.E. of Timor——G. C. Griffiths. The locality renders the specimens of much interest and value.

The following interesting series of moths from the Yorkshire district, illustrating the local development of melanism in that area, was presented by G. T. Porritt of Huddersfield, who has done so much valuable work on this subject:—12 melanic *Phigalia pedaria* (*pilosaria*) bred from a Huddersfield melanic male and normal female from an unknown locality; 10 melanic and 8 typical *Odontopera bidentata* from ova from S.W. Yorkshire; 10 melanic and 4 normal *Boarmia repandata* from ova from the Huddersfield neighbourhood; a variable series of 13 *Larentia multistrigaria* either captured or bred, Hudders-

field. An interesting comparison is afforded by 4 melanic *Hemerophila abruptaria* from the eggs laid by a melanic female from Upper Holloway.

Additions to the Collections in 1907.

Thirty-two beetles from Massarang Mt. (3-4000 ft.), N. Celebes (1895), collected by Charles Hose, Hon. D.Sc., Cantab.——the Linacre Department.

A fine *Nemoptera* from Cnidus, S.W. Asia Minor——W. Warde Fowler, M.A., Lincoln College.

Five insects, including an Asilid and its prey, a moth, forest near Aachen——the Professor.

Four *Cimex lectularius*, Sarawak, Borneo——The Principal Medical Officer.

An orange-coloured variety of the Noctuid moth *Bryophila perla*, St. Helen's, Isle of Wight——R. W. Poulton Palmer, B.A., Balliol.

Twelve examples of the beetle *Silvanus surinamensis*, in biscuits from China——Messrs. Huntley & Palmers.

A yellowish, strongly marked female *Pieris napi* (May), and the Noctuid moth *Luperina testacea*, Oxford district ——A. H. Hamm, of the Hope Department.

Twenty-eight specimens of the Galerucid beetle *Lochmaea suturalis* from the crop of *Tetrao tetrix*, Argyllshire ——F. Menteith Ogilvie, M.A., M.B. (Proc. Ent. Soc., Lond., 1907, p. lxxxiv).

Additions to the Collections in 1909.

A fine collection of 789 butterflies, S.E. Congo Free State (Feb.—Nov., 1907)——S. A. Neave, M.A., B.Sc., Magdalen. The area includes Kambove, Katanga, and many localities at various elevations in the valleys of the Lualaba, Lufira, Dikulwe, and Bunkeya Rivers. Among the specimens are co-types of the Danaine, *Amauris lobengula katangae*, the Pierines *Belenois picta* and *B. crawshayi lata*, and the Hesperid *Cyclopides kambove*, all described by Mr. Neave in Proc. Zool. Soc., 1910.

Other species much wanted by the University Collection, and many of them new to it, are *Amauris hyalitis dannfelti*, *Diestogyna iris* (a fine series), *Crenis trimeni*, *consors*, *amelia*, *occidentalicum*, *pechueli*, together with the beautiful mimic of the last-named, viz. *Crenidomimas concordia*, *Precis touhilimasa* and *actia* (a fine series of both), *Vanessula milca*, *Alaena oberthüri*, *Zeritis sorhageni*, *Papilio almansor*, and *Cyclopides formosus*. The locality adds greatly to the interest and value of the specimens.

A nearly equally fine set of 670 butterflies, N.E. Rhodesia (Sept.—Nov., 1908)——S. A. Neave. These butterflies form the remainder of the splendid collection of which part was acknowledged in the Report of 1909, where an account of the localities is given. Those now acknowledged and incorporated include the type of the Nymphaline *Euptera elabontas mweruensis*, of the *Lycaenidae*,—*Catochrysops cupreus* (co-types), *Lycaenesthes gemmifera* (type and co-type), *Deudorix bemba* (♀ type), types of the following *Hesperidae*,—*Platylesches lamba*, *Abantis lofu*, *Sarangesa nox*, *Parnara saxicola*. In addition to these specimens, of inestimable value to the systematist, a large proportion of the remainder are greatly wanted as species and the whole of them because of their interesting localities and admirably precise data.

Sixty-seven African *Chrysididae*, chiefly from the same localities as the above donation——S. A. Neave. This interesting series collected by the donor in his 1907 and 1908 journeys in N. Rhodesia and Katanga, has been kindly named by Rev. F. D. Morice. The most interesting species are *Chrysis* sp. ? *nasuta*, and *Hedychrum coelestinum*.

The non-mimetic male-like and the two mimetic females of *P. polytes*, together with the models of the latter, Ceylon——Prof. R. C. Punnett, M.A., F.R.S.

Two Lepidoptera, Taungdwingyi, Upper Burma, and 1 moth, Rangoon (1908)——E. F. Thornewill.

Eighty Diptera, W. Mersea, Essex——W. Wesché.

Additions to the Collections in 1910.

A fine collection of 1488 insects and 2 other Arthropoda, New Zealand (Jan.—Mch.)——G. B. Longstaff, M.A., D.M., New College, F.R.C.P. The collection was made in a great variety of localities in both North and South Islands, all the specimens being accompanied by admirable data. Lepidoptera form the chief part of the donation—106 butterflies and 846 moths, many of the latter being taken at "Sugar". The general facies of the moths and some of the butterflies is distinctly northern, perhaps to be accounted for by migration by means of the north-and-south mountain ranges of America and then by the Antarctic islands or continent. The fauna is so remarkable that a separate collection is being formed to illustrate it so that the species may be studied as a whole. A nearly complete series of butterflies had already been thus set aside from the collection presented some years ago by Commander J. J. Walker, and to this, 3 specimens of a Lycaenid were now added, while a representative collection of moths has been begun with 232 examples divided between 148 species. The names have been clearly printed and the whole collection is most conveniently arranged for study. Of the other insect groups the Coleoptera are represented by 167 specimens, Rhynchota 97, Orthoptera 84, Hymenoptera 80, Diptera 69, and Neuroptera 35. A Cicindelid beetle with its Forficulid prey and a Locustid devouring a moth, have been added to the bionomic collection.

One hundred and seventy-six insects, Australia (Mar., Apr.)——G. B. Longstaff. Localities in West Australia, South Australia, Victoria and especially New South Wales are represented. The Lepidoptera, 107 butterflies and 27 moths, were chiefly collected. Two examples of *Asilus discutiens*, each carrying the honey-bee as prey, have been added to the bionomic collection.

The following insects captured on the voyage out were also presented by Dr. Longstaff:—Tenerife (Dec. 16,

1909)—10; Cape Town (Dec. 31—Jan. 1)—11; on board ship in Indian Ocean (Jan. 8)—3 examples of the cockroach *Phyllodromia germanica*; Tasmania (Jan. 19—20 and again on Apr. 8—9)—83; and on the voyage home Ceylon (Apr. 27)—12, Aden (May 5)—7.

Twelve Orthoptera from the neighbourhood of Kuching, Borneo——the late R. Shelford.

A valuable series of Orthoptera (15 *Blattidae* and 10 *Phasmidae*)——the Paris Museum of Natural History. The type of the interesting cavernicolous cockroach *Alluaudella cavernicola* is included, together with co-types of 2 other Blattids and 3 Phasmids.

Twenty-four Lepidoptera from various localities in Algeria (Mch., Apr.) and 8 from Mürren, Bernese Oberland (July, Aug., 1907)——H. M. Wallis.

The following series of local forms bred by the donors at S. Woodford, N.E., were presented by the late A. Harrison and Hugh Main, B.Sc.:—

(1) Two males and 4 females of *Pieris napi* from 3 families each reared from eggs laid by a female of the var. *bryoniae*, Simplon (1907). The larvae were bred from the egg and the 12 female butterflies, which emerged May, 1908, are indistinguishable from characteristic Swiss *bryoniae*, the 6 males being typical *napi*, as in Switzerland. (2) Four *P. napi* from eggs laid at Enniskillen (1907); the butterflies, which emerged in July, are characteristic Irish forms. (3) Twelve *Aplecta nebulosa*—viz. 3 of the type form, 4 of the var. *robsoni*, 5 of the var. *thompsoni*—from ova or wild larvae, Delamere Forest, Cheshire (1907-9). (4) Two melanic *Odontopera bidentata*, from ova or small larvae, Horbury, near Wakefield (1908). These experiments in breeding show that the local forms are truly hereditary and not due to the direct action of the local surroundings; for they all kept true when reared amid the influences of a different environment. For this and other reasons the donation is a valuable addition to the University Collection.

Three examples of the huge flea *Hystricopsylla talpae* and 13 small fleas, from a mouse's nest made of feathers, Wytham Park, near Oxford (Apr.)——Commander J. J. Walker, late R.N., Hon. M.A.

Additions to the Collections in 1911.

Thirty-eight of the Nymphaline butterfly *Araschnia levana* with their pupa-cases, bred in Oxford (July), from young larvae from Mecklenburg——F. E. Merrifield.

Sixty-five Odonata and 5 Lepidoptera from various localities in Switzerland; 8 Odonata captured by P. J. Barraud at Itri, S. Central Italy (1910); 19 Odonata from Biskra, Algeria; 47 Odonates, 18 butterflies and 1 Hymenopteron from various localities in Newfoundland——E. R. Speyer, B.A., New College. An important addition to the fine collection of dragonflies in the Department.

Eighteen moths from Mortehoe, N. Devon——G. B. Longstaff. A part of the fine collection of insects from this locality, acknowledged in an earlier Report.

The wings of the Meadowbrown Butterfly (*E. janira*) found close together on the sand-dunes, Pendine, Caermarthenshire——R. I. Pocock, F.R.S., who believed that the insect's body had probably been eaten by a Wheatear.

The Noctuid moth *Cucullia umbratica*, with a pollen-mass of *Orchis maculata* attached, found on a post at Onich, Inverness-shire (Aug. 1909)——Prof. R. Meldola, F.R.S. ("Entomologist," 1909, p. 281; 1910, p. 106, f. 2.)

Ninety-three Platypezid flies, belonging to 4 species determined by F. W. Edwards, Sheviock, nr. St. Germans, Cornwall——Col. J. W. Yerbury. Also a spider taken in the Oxford Univ. Museum (1902).

The three following donations are from St. Helen's, Isle of Wight:—

One *Lycaena icarus* (the Common Blue) with an injury, observed before capture, to the costal margins of both fore wings——C. A. Wiggins.

A dragonfly——Dr. E. W. Ainley Walker, D.M., University.

Five insects from St. Helen's and Oxford——the Professor.

The following donation is almost entirely, the remaining 1911 donations entirely, from the Oxford district:—

Forty-eight insects of various groups (1907-11)——A. H. Hamm. The series includes 4 *Setulia grisea*, a Tachinid fly new to Great Britain (E. M. M., 1909, p. 273), from near Beaulieu Rd. Station (1909); 11 *Brachycoma devia*, with their puparia, bred from the nest of the humble-bee, *Bombus harrisellus*, Day's Lock, Dorchester; 2 mole-fleas, *H. talpae*, *in coitû*, the male and female types of the variety *flava*, Hamm, of *Sitaris muralis*, Cowley (1909); 2 butterflies, *Polyommatus phlaeas* and *Coenonympha pamphilus*, with injuries, noted before capture, probably caused by birds.

A Death's Head Hawkmoth (*A. atropos*) from New Marston (Sept. 13)——Mrs. Austin. The moth was flying round a lamp in the house.

A Privet Hawkmoth (*S. ligustri*) at rest on the wall of All Soul's and attacked by a sparrow——F. Waller. The attack was seen by the donor.

The hind wings of a Yellow Underwing Moth (*T. pronuba*) eaten by a sparrow (1910)——H. Eltringham, M.A., D.Sc., New College. Attack also witnessed by the donor.

Two beetles, *Donacia sericia*, from the R. Cherwell——G. C. Hartley.

A Syrphid fly, *Merodon equestris*, and a beetle, *Blaps*, with a parasitic *Gordius*——W. Holland.

Five Hemiptera, *Anthocoris nemoralis* var., Box, Wantage (1910)——H. A. Saunders, M.A., Keble.

A tick from a tortoise and another from a dog——Miss Poulton.

Additions to the Collections in 1912.

Hitherto uncatalogued accessions in 1912 are, when

presented by the same donor, followed by those of earlier years, as indicated by dates at the beginning of the paragraphs. When no such date appears 1912 is always to be understood. The additions are grouped geographically in the following order: Africa, Oriental Region, America (N. to S.), Europe, British.

Eight Lepidoptera, 4 Aculeate Hymenoptera and 1 Phasmid, from Port Lokkoh in the Karene district of Sierra Leone (about 70 ft,)——Mrs. M. Addison. The butterflies include *Acraea encedon*, form *alcippina*, the white-hind-winged variety especially developed in Sierra Leone in mimicry of the dominant W. African form of *Danaida chrysippus*.

1911.—Also by the same donor, seven butterflies, 140 moths, and 16 insects of other Orders from the Kennema Railway District (about 200 ft.) of Sierra Leone, together with 8 insects from Shengay, about sea level (1910-11). The butterflies include a female of *Aphnaeus orcas* and a male of *Epitola honorius*. The moths, a particularly interesting series, include a new Catocalid recently described by Sir George Hampson as *Homaea addisonae*.

An interesting series of 32 insects and other Arthropoda, from Faras (about 400 ft.), 25 miles N. of the Second Nile Cataract —— Prof. F. Ll. Griffith, M.A., Queen's.

A very fine set of 371 moths with the species determined, 69 Coleoptera, 56 Rhynchota, 37 Neuroptera, 30 Orthoptera and 4 Diptera, White Nile localities (Jan.—Apr.)——G. B. Longstaff.

Forty-three insects of various groups, Port St. Johns, W. Pondoland, S. Africa——the late Herbert Druce, F.L.S. The butterflies include 5 *Acraea igola*. The locality renders the specimens of much value to the collection.

Three Danaine butterflies (*Amauris*) for the General Collection and 4 for the Mimicry Collection, from Bitja, Ja River, Cameroons (about 2000 ft.), captured Apr.—

Jun., 1910, were purchased from Messrs. W. F. H. Rosenberg. The latter set has been placed with the mimetic Danaine *Tirumala morgeni*, from the same locality. Also purchased from the same Firm 5 Papilios from Formosa.

A fine series of named Termites—54 mounted specimens—from various localities and at various dates in India and Ceylon——T. Bainbrigge Fletcher, Director of the Agricultural College, Coimbatore, Madras. The collection includes several species, and 7 co-types of *Eutermes lacustris*, Bugnion, from Ceylon.

The following valuable accessions were presented by H. H. Banks: 1912.—One Longicorn beetle taken on the ship off Perim.

1911, 1910.– One hundred and fifty-eight Hymenoptera in 1910, together with 65 Hymenoptera, 26 Coleoptera, and 3 Homoptera in 1911, principally from the Seremban District, Negri Sembelan State, Fed. Mal. States. Also from the same locality a Fossorial wasp allied to *Tachytes* with its prey, an Acheted, and another related species with a spider. Several of the 1910 captures were made in the Kinta District of Perak State.

Eighty-four insects of various groups, especially moths, from the Singapore Botanical Gardens (1905)——H. N. Ridley, M.A., Exeter, F.R.S.

Forty insects of various groups, chiefly Lepidoptera, from the Langkon Estate, Kudat, Marudu Bay, British N. Borneo (1911-12)——J. F. Hornsey, B.M., Wadham. The butterflies include a beautiful mimetic *Hypolimnas*, and the mimetic female and non-mimetic male of the Bornean form of *Papilio polytes* captured *in coitû* (Mch. 3, 1912).

Thirty-one butterflies from the forest near Port of Spain, Trinidad——Guy A. K. Marshall. The series includes an example of the Nymphaline *Protogonius* and its chief model in Trinidad, the Ithomiine *Tithorea megara*, taken on the same day, Feb. 4; also a Hesperid ex-

hibiting injuries due to the attack of an enemy, probably a bird.

The following valuable series were presented by the late Herbert Druce, F.L.S.:—(1) Three hundred and fifteen moths (117 *Geometridae* and 198 small moths, mostly Pyrales) collected by Watkins, about 1906, at La Merced, Chanchamayo, Peru (1000 metres). (2) One hundred and thirty-three moths, chiefly *Noctuidae*, from Jalapa, S.E. Mexico (about 1898). 1910.—(3) Twenty Ithomiine butterflies from Venezuela.

One hundred and twenty Coleoptera, 9 Hemiptera and 3 Hymenoptera, Blankenberghe, Holland——H. St. J. K. Donisthorpe.

Additions to the British Collections in 1912.

One hundred and two moths, chiefly *Noctuidae*, from various localities, especially in the neighbourhood of Mortehoe, N. Devon (various dates since 1884)——Dr. F. A. Dixey, M.A., D.M., Wadham, F.R.S. The series includes 4 *Cucullia absinthii* bred in 1902 from larvae found by Dr. G. B. Longstaff, and 2 *Polia xanthomista*, including one of the two captured at Sugar (1890) and recorded in the *Entom. Monthly Mag.* (1893, p. 57) and in Barrett's "British Lepidoptera" (IV., 1897, p. 302). Specimens from Highgate Wood (1876) and other London localities are also included.

One hundred and six moths from many localities (1899—1911)——C. F. Johnson. The series includes many rare species such as 1 *Pachnobia alpina* and 4 *Asteroscopus nubeculosa* from Rannoch, 8 bred *Hadena glauca* from Rannoch and Staffordshire, 13 *Epione parallelaria* (*vespertaria*) from near York.

Four *Luperina gueneei*, captured by A. Murray at St. Anne's-on-Sea, Lancashire (1911)——B. H. Crabtree.

Two *Polia nigrocincta*, taken at Sugar, Gurnard's Head, Cornwall (1911), and 8 *Eupithecia jasioneata* bred (1912) from larvae found near Penzance——G. B. Kershaw.

An example of the Arctiid moth *Euchelia jacobaeae* seen to be captured while flying and then abandoned by a robin (Woking, June 20, 1912)——Roland Trimen, F.R.S. (Proc. Ent. Soc., 1912, p.p. xc., xci.)

Thirty-seven Coleoptera, Hampshire, Surrey——C. J. C. Pool. The series includes 3 *Philydrus quadripunctatus*, new to Britain, 1 *Hister purpurascens*, and 15 *Harpalus aeneus* shewing colour variations in a single colony.

Twenty Diptera from the New Forest (1902—1910) F. C. Adams. The series includes 9 beautifully-mounted Tipulids, and 5 examples of *Empis tessellata* with their Dipterous prey—a *Leptis*, a Tachinid and 3 Tipulids.

One *Carabus nitens*, Loch Lomond; 3 males and 2 females of the rare beetle *Hylecoetus dermestoides* from a log of Scotch pine, Ardlui, Loch Lomond ("Entom. Record," 1912, p. 191)——R. S. Bagnall. Two of the males are dark colour varieties.

One Red Admiral butterfly, *Pyrameis atalanta*, St. Helen's, Isle of Wight (Aug., 1903), evidently attacked while the wings were still soft——the Professor.

Six of the Geometrid moth *Thera variata*, Chandler's Ford——Major R. B. Robertson. This species was first recognised as British by the donor.

Four parasitic Diptera from birds and cattle——The British Museum of Natural History.

The following captures, except when otherwise stated, were effected in the Oxford district, and in the year 1912:—

Ten Lepidoptera, Oxford (1911, 1912)——A. H. Hamm; also for the bionomic collection a female *Lycaena argiolus* in spider's web, Oxford Univ. Museum; a *Cidaria truncata* (*russata*) with the hind margins of the wings on right side shorn cleanly off, Headington; a Hemipteron, *Pentatoma rufipes*, much injured, Magdalen Bridge; a male and female Burying beetle, *Necrophorus vespillo*, flying together, near Cowley. On the wing they were taken for Humble-

bees and Mr. Hamm considers it likely that the elytra are nearly closed during flight, exposing the pattern of the upper surface; a fly, *Limosina* sp., with an immense load of *Acari*.

Thirty-one insects of various groups——J. Collins, of the Hope Department. The series includes 6 of the rare Dolichopid fly *Scellus notatus*, 8 of the rare beetle *Orectochilus villosus* (Aug., 1910), 2 *Lathrobium pallidum*, 5 *Aphthena nigriceps*; also 1 *Empis tessellata* with Tipulid prey.

One *L. argiolus* (Oxford) and 1 Galerucid beetle (Malvern)——H. Trim.

One Locustid and 1 Culicid——Commander J. J. Walker.

One *Reduvius personatus* (Hemiptera), Marston——R. S. Bagnall.

One *Empis livida* with prey, Bagley Wood——Colbran J. Wainwright.

One Lime hawkmoth, *Smerinthus tiliae*——Mrs. Rawlings; also 1 Poplar hawkmoth (*S. populi*), Oxford (July) ——Brought to the Museum.

Additions to the Collections in 1913.

The arrangement adopted is the same as that explained under 1912.

A wonderfully interesting family of *Papilio dardanus*, bred from a *hippocoon* female form captured Nov. 19, 1913, at Moor Plantation, near Ibadan, S. Nigeria—— W. A. Lamborn, late Entomologist to the Agric. Dept. of S. Nigeria. The family consisted of 15 males, 9 *hippocoon* and 8 *dionysus* females, this being the first occasion on which these latter remarkable W.-coast forms have been bred. Thirty of the butterflies are accompanied by their respective pupa-cases. Many of the pupae had been exposed to artificial cold and some to a moist atmosphere, but there was no evidence of any effect produced upon the resulting butterflies. The mimetic *hippocoon* females were very constant in pattern, while their

non-mimetic *dionysus* sisters were extremely variable. The family was exhibited to the Ent. Soc., June 3, 1914. See Proceedings, pp, lxiii.—lxx., where it is argued that the *hippocoon* form is a Mendelian recessive, *dionysus* a dominant, and that the female parent had paired with a male heterozygote. Such parentage should give half recessives and half heterozygotes, the latter having the appearance of the dominant *dionysus*.

The following specimens bred in 1912, 1911 and 1910 at Oni camp in the Lagos district of S. Nigeria and presented by W. A. Lamborn have been catalogued and incorporated since the appearance of the Reports for those years:—

1912.—Three families—D, E, F—bred from the eggs respectively laid by three captured *hippocoon* females of *Papilio dardanus*. The whole of the female offspring were *hippocoon*, viz. 14 with 10 males in D, 7 with 2 males in E, 6 with 4 males in F. Many of the pupa-cases of D are also included. The pupae of this family were exposed to artificial cold, and at first it appeared that the rudimentary "tails" on the hind wing of some of the female offspring were probably thus caused. The 1913 experiments throw doubt upon this interpretation (see p. 33). An account of these three families has been published in Proc. Ent. Soc., 1912, pp. cxxxi.—cxxxiv.

Two male and 2 female *Hypolimnas* (*Euralia*) *anthedon*, examples of an all-*anthedon* family, and 5 male and 3 female *H.* (*E.*) *dubia* examples of an all-*dubia* family. Each family was reared from the eggs laid by a captured female of unknown form, unfortunately mislaid or more probably lost in the post.

1911.—A family of 37 butterflies reared from the eggs laid by a single female of the Danaine butterfly *Amauris psyttalea* which unfortunately escaped. The offspring exhibit the most complete transition between the two "species"—*psyttalea* and *bulbifera* (Proc. Ent. Soc., 1912,

pp. lxxvii., lxxviii.). Thirty-five pupal cases and many larval skins are also included.

A second family of 18 *A. psyttalea* reared from a company of larvae, the product of a single batch of eggs, found in Oni clearing. Seven pupal cases are included. This family also shows transition to *bulbifera* (Proc. Ent. Soc., *ibid*).

A family of 14 *Danaida chrysippus*, form *alcippus*, together with the female parent of the same form, captured in Oni clearing. Many pupal cases and larval skins are included. In addition, 2 *alcippus* and 2 *Amauris niavius* (with their pupa-cases) bred from larvae found singly. Although *D. chrysippus* is such an abundant and wide-ranging species, this is, it is believed, the first time that the butterflies have been reared from the eggs laid by a known female.

1910.—A family of 29 *Salamis cacta* bred from a company of small larvae found on the top of a single leaf in the forest 2 miles E. of Oni. Also 28 pupa-cases, of which 19 accompanied their respective butterflies, and many larval skins of different ages. The butterflies are "set" to show the great range of variation of the under surface and the different patterns into which the individuals are grouped (Proc. Ent. Soc., 1912, pp. lxxv., lxxvi.).

The following fine collection of insects, chiefly Lepidoptera (1910-13), presented by J. A. de Gaye, have now been incorporated :—

(1) Fifty-four butterflies, 191 moths, 130 insects of other groups, King's College grounds, Lagos. The butterflies include the female type of *Epamera degayei*, H. H. Druce, *Myrina subornata* and many other species of much value to the collection. Among the moths is an interesting series of *Sphingidae* captured at lilies, 6.30 p.m., June 17—24:—23 *Nephele peneus peneus*, 8 *N. peneus innotata*, 1 *N. accentifera*.

(2) Eighty-two butterflies, 31 moths, 79 Coleoptera, 54 insects of other groups and 3 *Acari*, Ikoyi Plain, Lagos.

The butterflies are a most valuable and interesting set, including the male type of *Epamera degayei*, *Pyrrhochalcia iphis* and its Agaristid mimic *Messaga monteironis*, shewn at the Ent. Soc., Nov. 6, 1912 (Proc., p. cix.). The Hymenoptera include parasites bred from *Acraea zetes.*

(3) Fifty-five butterflies, 22 moths, and 3 other insects, Ebute Metta Botanical Garden, Lagos. The butterflies include a pair of *Euxanthe eurinome*, *Planema vestalis*, *Ploetzia cerymica*, *&c.*

(4) Nineteen moths, at light, Iju, 13 miles from Lagos.

(5) A fine bred series of 11 females and 1 male of the Lasiocampid moth *Taragama vesta* with 11 cocoons, Lagos. The male is quite unlike the female and was only recognised as belonging to the same species after both sexes had been bred by Mr. de Gaye and Dr. G. D. H. Carpenter.

The female parent, of the *planemoides* female form of *Papilio dardanus*, with its 12 male, 3 *planemoides* and 7 *hippocoon* female offspring bred, Bugalla I., Sesse Archipelago, N.W. Victoria Nyanza——G. D. H. Carpenter, D.M., Non-Coll. The first and only time that the *planemoides* form has been bred or bred from. This most interesting family is described in Proc. Ent. Soc., 1913, pp. xxxiii.—xxxv., liii.—lvi., and figured in Trans., 1913, Plate xxxix.

A very interesting series of 224 butterflies and 1 moth, Nuba Hills, between El Obeid and Lake No, Anglo-Egyptian Sudan (1904-06), captured by R. S. Wilson ——C. A. Willis, B.A., Magdalen. It is hoped that an account of the collection will soon be published. The tropical forms from further south which extend into the forested Nuba Hills are of great interest. Among the species is the rare *Acraea sykesi* and many *Lycaenidae* and *Hesperidae* greatly wanted by the University Collection. Indeed the locality confers great value upon the whole. The data are admirably detailed and precise.

A female of the very rare Danaine *Tirumala morgeni*,

from the Cameroons (1909), and a beautiful variety of the female *Papilio dardanus* from Entebbe (1906)——H. Eltringham. Both are new to the collection and a valuable addition to it.

Twenty-seven butterflies (including 4 *Planema poggei*, 1 *T. mercedonia* and a series of varieties of *D. chrysippus* with the form *albinus*), and the Arctiid moth *Rhodogastria leucoptera*, from many localities between Entebbe and Hoima, the capital of Unyoro (1910)——C. A. Wiggins, D.P.M.O. of the Uganda Protectorate, who has done so much for the University Collections, rendering them pre-eminent in insects from Uganda.

Seventy-one butterflies and 2 moths from about 1° S., and 35° E., British East Africa (5-6000 ft.)——H. B. Popplewell, B.A., Lincoln. The butterflies include 4 males and 1 female *Tirumala formosa*, and some interesting Lycaenids.

The following valuable series were presented by the Entomological Research Committee of the Colonial Office:—

1913.—(1) Thirty-seven insects of various orders captured in British East Africa by S. L. Hinde. The series is of all the greater value because the species had been determined in the British Museum (N.H.).

(2) One hundred and ninety-one named, blood-sucking, Ethiopian Diptera, including 61 *Glossina* (tsetse flies) of 5 species—*palpalis*, *morsitans*, *tachinoides*, *fusca*, *pallidipes*, 51 specimens belonging to various species of *Tabanus*, 10 of *Chrysops*, 44 of *Haematopota*, 8 of *Stomoxys*, 6 of *Hippobosca* and 11 of *Culex*.

1912.—(3) Twenty-five male *Planema macarista* collected by S. A. Neave in various localities in Uganda (1911-12).

1911.—(4) A valuable set of 78 Acraeas, collected by S. A. Neave in the Kenia district of British East Africa and near Mt. Elgon in N.E. Uganda. The species are 11 *Acraea uvui* (several forms with dark under surface; 2 pairs *in coitû*), 1 *doubledayi sykesi*, 2 *astrigera* (1 female

form *brunnea*), 13 *conjuncta* (three of the female forms—*mutata*, *pica*, and *lutealba* new to collection), 8 *anacreon anacreontica* (new to collection), 36 *johnstoni* (a fine set of female forms), 3 *disjuncta*, 3 *melanoxantha* (new to collection), 2 *caecilia* (*in coitû*).

Eleven *Acraeinae* from Bulawayo (1913) and the Victoria Falls (1912)——G. Arnold, M.Sc., A.R.C.S., Curator of the Bulawayo Museum. The series is a welcome addition to the very fine collection of African *Acraeinae*.

Two examples of *Anaphe panda* bred 1911 at Mt. Chirinda, S.E. Rhodesia——C. F. M. Swynnerton. These moths are the first-fruits of a splendid collection which will be labelled and incorporated in the near future.

The following very interesting specimens were presented by E. A. Elliot:—

1913.—(1) Three male examples of *Danaida chrysippus f. alcippus* captured by Fairfax Prevost in Palma, Canary Isles (1903). The occurrence of this, the chief West African form, in Palma is extremely interesting; inasmuch as the type form of the species exists in Tenerife.

1912.—(2) Seven male *Papilio dardanus* captured about 1903-4 in the Nairobi district of Brit. East Africa by the late C. F. Elliott. The series exhibits a wide range of variation and includes some interesting forms with pale spots in the black margin of the fore wing.

A valuable collection of 234 Diptera, chiefly *Bombyliidae*, from the neighbourhood of Aden (Feb.—Apr., 1895)——Col. J. W. Yerbury. The localities—Lahej, Haithalhim, Shaik Othman, and Huswah, in addition to Aden itself, are always recorded, together with the precise dates of capture. The great majority of the species have been determined by the generous donor, who has now added this important series to the *Asilidae* and the *Syrphidae* from the same localities. In addition to the above, 8 Diptera from various European localities (1898, &c.) were presented by Col. Yerbury. They include examples from the Mendel Pass, Tyrol, captured by F. C. Lemann.

Fourteen Rhynchota, of 11 species named by Dr. G. Horvath, together with 8 Diptera of 6 species named by E. Brunetti, F. H. Edwards and Miss S. L. M. Summers, from Palestine (1912)——N. Annandale, D.Sc., M.A., Balliol, Director of the Indian Museum, Calcutta.

Two males and two females of the rare and beautiful Sphingid moth *Marumba nympha*, bred at Karwar, N. Kanara (1909) by T. R. Bell——the British Museum (N.H.).

A male *Appias libythea, in cop.* with a female *Teracolus limbatus*, captured by A. P. Green, Apr., 1887, at Aripu, on the coast of the dry N. Province of Ceylon——E. Ernest Green. Such abnormal unions between species of very different genera are extremely rare, and it is of much importance that the material should be preserved and available for study. The two specimens, still united, were exhibited at the Ent. Soc. (Proc., 1913, pp. cv., cvi.).

A valuable set of 137 insects of various orders and 5 other Arthropods from the neighbourhood of Kuantan, Pahang, Federated Malay States——Vernon G. Bell.

Thirty-one Asilid flies from How-lik Monastery, near Hongkong (1907)——J. C. Kershaw. This interesting addition to the collection of *Asilidae* includes 2 species of *Dasypogoninae*, both *Microstylum*, and 4 of *Asilinae*.

Six males of the fine Pierine butterfly *Delias eumolpe*, hitherto unrepresented in the collection, from the W. spur of Mt. Kinabalu (3300 ft.), British North Borneo ——J. C. Moulton, B.Sc,, Magdalen, Curator of the Sarawak Museum, Kuching.

1912.—By the same donor, thirteen butterflies from Sarawak (1910), much wanted by the Department.

A pair of *Ornithoptera alexandrae*, probably the most magnificent butterfly in the world——the Hon. N. Charles Rothschild. The specimens were bred from larvae found in the Owen Stanley Range in South-east New Guinea. The species is new to the collection and an extremely fine accession.

Eighty-three Lepidoptera taken within 7 miles of Healesville, on the wooded foothills (300—1800 ft.) of the dividing range of Victoria, Australia——Dr. A. Eland Shaw. The series of *Satyrinae* among the butterflies and of *Hepialidae* ("Swifts") among the moths are especially fine accessions to the collection.

Forty-two beetles and 1 Fossorial wasp from woods near Vernon, Canada, B. C. (1911-12), the beetles including a few examples from Manitou, Manitoba plains ——A. W. Sharp. The species have been kindly identified by W. E. Sharp, father of the donor.

Three moths, East End, S. Saskatchewan——G. S. Thornewill.

A collection of 150 insects from Phoenix (1100 ft.) and Prescott (6000 ft.), Arizona (1908-12) —— Dr. R. E. Kunzé, who has done so much for the Hope Department in previous years. The butterflies include a long series of *Danaida strigosa* and its Nymphaline mimic *Limenitis obsoleta* (*hultsti*), and of the rare Pierine *Anthocharis pima.* Among the other groups the Orthoptera were represented by a valuable set of 65 specimens, chiefly *Locustidae.*

In addition to the above, the following valuable accessions were presented by the same generous donor:—California (1912-13), collected by H. Kusche and J. B. Cottle, 8 butterflies, including 6 *Adelpha californica*, 15 moths (one fine Saturnid) and 2 beetles; Montana, Helena (1907), collected by W. M. Mann, 4 Lepidoptera including a fine *Melitaea* and Catocalid moth; New York State, W. Catskill Mts., Jefferson, collected by Miss Anna McNamee, 10 butterflies, including the rare form *proserpina* of *Limenitis astyanax*; Catskill Mts. (1909-10), 35 butterflies; California, chiefly Oakland (1908), collected by G. R. Pilate, 74 butterflies; Colorado, 27 Coleoptera; Greaterville, Arizona, 13 Coleoptera; Texas, 13 Coleoptera.

A fine series of Lepidoptera from the following Neotropical localities——W. Schaus, who has so generously

helped the University Collections on many previous occasions:—

(1) Mexico (many localities, 1906)—32 Lepidoptera.

(2) Costa Rica (many localities, 1907-9)—a fine set of 86 butterflies, including a beautiful mimetic *Papilio*, and 30 moths, including 12 very fine *Sphingidae*.

(3) Panama, Bejuco River (1909)—3 *Ithomiinae*.

(4) Surinam River, Geldersland (1904)—4 *Ithomiinae*; French Guiana—6 *Ithomiinae* and *Danainae*, shewing with the Surinam specimens the blackened hind wing characteristic of the most important synaposematic association in the Guianas.

(5) Cuba—8 Lepidoptera.

A butterfly, *Catagramma*, from British Honduras (1910)——H. Bilborough.

A very fine collection of 739 butterflies and 6 moths from Trinidad——Rev. K. St. Aubyn Rogers, M.A., Wadham. The specimens are all the more valuable because of the number of localities represented, some of them being on the South coast and in the southern mountain range, others in the central range. Altogether 14 different forms of locality label were printed. The butterflies include representatives of nearly every group, and among the moths are 2 Castniids and a Uranid. A synaposematic series of 2 *Ithomiinae*, 1 *Lycorea*, and 1 *Eueides* captured together in the forest, Emperor's Valley, Port of Spain, on Feb. 3, have been added to the bionomic series. The collection has been studied by W. J. Kaye, the principal authority on the butterflies of the island, who has found in it and has described 1 new Erycinid, *Mesene simpla*, and 5 new Hesperids, *Myscelus rogersi*, *Euroto simplissima*, *E. cocoa*, *Cobalopsis musa*, and *C. rogersi*. The collection also contained 2 Nymphalines, 1 Erycinid, 2 *Lycaenids*, and 9 Hesperids hitherto unrecorded from Trinidad. (Trans. Ent. Soc., 1913, p. 545.)

Forty-seven Lepidoptera and 82 insects of various orders and other Arthropoda collected in 1896 by J.

Quelch on the Corentyne River, forming the boundary between British and Dutch Guiana——Richard Evans, D.M., D.Sc., Jesus. The locality renders the insects of much interest. These specimens which were presented to the Department several years ago, had been overlooked, and having been recovered and labelled in 1913 are added to the catalogue of that year.

Seventy-two butterflies, 10 moths and 5 dragonflies from the neighbourhood of S. Paulo, S.E. Brazil——Miss Diana R. Wilson (Mrs. Fyson). The butterflies include *Penetes pamphanis*, a fine and rare species of *Brassolinae*, described by Professor Westwood, but hitherto unrepresented in the University Collection; also 3 examples of a beautiful little Erycinid, apparently the same as a hitherto unnamed local form collected by W. J. Burchell at S. Paulo about 1827. The mimicry collection is also enriched by examples of models belonging to the *Pharmacophagus* section of the Papilios, viz., *Papilio chamissonia*, and mimics belonging to the *Cosmodesmus* section of the same sub-family—*P. lysithous*: also for the same series, the *Pharmacophagus* model *P. polydamas*, and its mimic *P. scamander grayi*, belonging to the *Papilio* section of the group. These interesting examples were not only taken in the same locality, but sometimes flying together on the same day. Although the mimetic resemblances illustrated in this collection are well known, the habits of the species have never before been described. See Proc. Ent. Soc., 1913, pp. cxix.—cxxii., where Miss Wilson records these and many other interesting observations.

Fourteen Lepidoptera from Estancia do Rey, Banda Oriental, Uruguay (1905)——Mrs. E. S. Craig.

Twenty-five butterflies from Concepcion (about 3300 ft.), Prov. Tucuman, N.W. Argentine——C. M. Dammers, who has previously assisted the University collections with specimens from this most interesting locality. Four examples of the rare *Tatochila immaculata* (*Pierinae*) are

included (Proc. Ent. Soc., 1913, p. xliii.); but the whole series is most welcome.

M. Charles Oberthür of Rennes again generously presented the University Collections with the following fine series of butterflies from localities some of which are better represented in his magnificent collection than in any other in the world:—

(1) W. China, Szu-chuan, about 30° N., 102·5° E., Tatsien-lu, and Siao-lou and Tien-tsuen near it (1897—1910): also W. Szu-chuan, Traku and Venchuan (1891) —120 butterflies, a splendid series especially of *Nymphalinae*, and 8 moths. Also from the E. frontier of Tibet (1905) and Tchang Kou (1892), 6 butterflies, including 2 *Armandia thaidina*.

(2) S.W. China, N. Yunnan, about 26·5° N., 101° E., Tse-kou, on R. Yang-tse-kiang (1902-9)—16 butterflies.

(3) E. Java, an example of *Acraea vesta*.

(4) Madagascar and the Comoro Islands (1885-96)—16 Acraeas, including a series of 9 *A. encedon* which has been of great assistance in the preparation of a paper in Journ. Linn. Soc. Zool., vol. xxxii., 1914, p. 391. Also a beautiful example of the extraordinary *Hypolimnas dexithea*, of which the University collection contained only 2 imperfect specimens very cleverly repaired by Professor Westwood.

(5) Congo State (various localities, 1900-4) and Cameroons (1896-8)—19 *Acraeinae*.

The following valuable accessions to the collections of Lepidoptera were presented by J. J. Joicey, Hertford:—

(1) Central Madagascar, 2500 ft. (1911), collected by F. B. Pratt—33 butterflies and 42 moths, a very interesting series much needed by the Department.

(2) New Guinea (1902—1910), collected by A. E., C. B., and F. B. Pratt, a fine series of 141 butterflies and 106 moths from various localities, including Dorei Bay; Wendisi, Amberfron and Mioswar Islands in Geelvink Bay; Hatam (3000 ft.), Momi (4500) and Warmasin (6000) in

the Arfak Mtns.; Fak Fak, Sourabaya, Jobi I (Wooi Bay), River Uty in Dutch N. Guinea; Dinawa (4000), Ekeikei (1500) in British N. Guinea. A few specimens from the Aru Islands are also included. Until quite recently this extremely rich and interesting island of New Guinea has been almost unrepresented in the University collections. Now, however, owing to this and earlier gifts by the same and other generous donors, the gap is being filled in a very satisfactory manner. The fine series from British N. Guinea presented by G. N. Carson, and from Bwaidogo, Goodenough I. (D'Entrecasteaux group) by D. Jenness, B.A., Balliol, shortly to be labelled and catalogued, will be a further important addition to this most interesting Lepidopterous fauna.

(3) Andes of N. Peru (1912), collected by A. E. and F. B. Pratt—a fine series of 276 butterflies and 118 moths from many localities, principally on the E. slope, and varying in elevation from 1000 to 7000 ft. This extremely rich Lepidopterous fauna is also poorly represented in the University Collection, and the donation is correspondingly valuable. The data accompanying all these specimens from Madagascar, New Guinea and Peru are admirably detailed, and add immensely to the value of the specimens.

The following series of butterflies, &c., presented by G. B. Longstaff:—

(1) Dominica—80, of many groups, mostly from the Rosean Valley, some of them from Canefield in the latter locality, captured by C. Ingram.

(2) St. Lucia, Castries and the neighbourhood—34.

(3) Barbados (1912)—16, of which one was taken at sea 140 miles N.E. of the island and 10 on the island itself, by Rev. K. St. Aubyn Rogers.

(4) St. Vincent Harbour, at the ship's lights—2 moths and 2 beetles.

(5) Grenada—11 butterflies, of which one was taken at sea S. of the island.

(6) Trinidad, Emperor's Vale, Port of Spain—110 of nearly all groups, including 4 taken by Rev. St. Aubyn Rogers.

(7) Venezuela, neighbourhood of La Guaira—195, of nearly all groups. These West Indian and South American specimens, accompanied by admirable data, are a very valuable accession.

(8) A valuable series of 226 butterflies and 194 insects of other orders, principally Coleoptera, from Southern Spain (Jan.—Apr.). The localities are Gibraltar, Ronda, Granada, Sevilla, Cordova, and Algeciras or in the neighbourhood of these places. The butterflies include 17 *Thais rumina* (one being the var. *canteneri*), a good series of *Synchloe tagis* from Ronda, its special locality. Dr. Longstaff found that the scent differed from that of an allied species, *S. bellidice*, captured with it, and observed that *T. rumina* has the characteristics of a protected species (Proc. Ent. Soc., 1913, pp. lxxxvii.—lxxxviii.).

(9) Two examples of *Pyrameis indica*, form *vulcania*, 1 moth and 4 Coleoptera from Las Palmas, Grand Canary.

Six ants, Jaca, N. Spain——E. R. Speyer.

The following valuable additions to the collection have been presented by Commander J. J. Walker:—

(1) A male and female of the Lasiocampid moth *Megasoma repandum*, from Gibraltar (1888), (Trans. Ent. Soc., 1890, p. 382).

(2) 219 butterflies and 18 moths collected by C. T. Bowring in the Wenchow district of S.E. China (1912). These Chinese Lepidoptera, from a district hitherto unrepresented are of the greatest value to the Department. The moths include a beautiful mimetic Uranid.

(3) A pair of the very fine butterfly *Euploea jessica*, from the New Hebrides (1900), the male captured by the donor in Palao Bay, Efate I., the female by T. Truss in Malekula I. The species was previously unrepresented in the University Collections.

(4) A valuable series of 9 examples of the Pierine

genus *Tatochila* from many S. American localities. The specimens, which were all captured (at various dates) by the donor and are accompanied by admirable data, are an important addition to the very fine collection of Pierine butterflies in the Department.

1902.—(5) An interesting mimetic combination of 11 insects from the Sydney district of New South Wales. The central model is the common Australian Lycid beetle *Porrostoma rufipennis* (4 examples), the mimics being 2 or 3 species of *Mylabridae* (3 ex.), 1 Longicorn and the weevil *Rhinotia haemoptera* (3 ex.).

The following specimens, forming the material of interesting communications to the Ent. Soc. (Proc. 1913, pp. xxxii.—xxxiii., xlix.—liii.), were presented by the captor Dr. Adalbert Seitz of Darmstadt:—from Batna, Algeria—the Asilid fly *Heliogmoneura brunnipes* and an example of the Oncodid (Cyrtid) fly *Physegaster maculatus*, a species Dr. Seitz records as the victim of the Asilid; from S.E. Brazil, on the road, passing through high forest, between Santos and S. Vicente (about 1888)—the Fossorial wasp *Pepsis sapphirus* with its mimics the Hemipteron *Spiniger ater* and the Locustid *Scaphura nigra*, var. *vigorsii*, exceedingly beautiful examples of mimicry fully described in the above communication, [the group being completed by an example of *Macrocneme lades*, from Castro, Parana (1910)——W. J. Kaye]; from Hong-Kong, Singapore and Ceylon—examples of the mimetic female forms or non-mimetic male-like forms of *Papilio polytes* characteristic of these localities.

Twenty-three butterflies and 35 moths, various localities in S. England——F. C. Woodforde, B.A., Exeter. For the general collection of Lepidoptera.

Additions to the British Collections in 1913.

The following valuable accessions, especially of Coleoptera, have been presented by H. St. J. K. Donisthorpe, the captor of nearly all the insects, who has done so much for the British Collections during so many years:—

(1) Sixty-four beetles and 4 Hemiptera from Lundy Island. The beetles include *Melanophthalmus distinguendus* peculiar to the island, and the whole collection is of much interest because of the locality.

(2) One hundred Coleoptera from various localities in Surrey, Middlesex, Cornwall, Inverness, Co. Kerry, &c. (1912-13) including several rare and interesting northern forms and 5 species not previously given by the generous donor; also from several localities, 22 insects of various Orders, including 1 male and 3 wingless females of the Geometrid moth *Nyssia zonaria* from Tiree island—a new record; 2 Ectoparasites—*Trichodectes latus* and *Haematopinus piliferus*—from a Pekinese spaniel; and 2 Mallophaga (*Menopon* sp.) on Plover's eggs, Tiree (1912); for the bionomic series, a spider (*Philodromus*) with its prey the beetle *Grypidius equiseti* from Luccombe Chine, Isle of Wight (1909); and, for the series illustrating distribution, 3 accidentally introduced beetles from Kew Gardens (1911).

(3) An interesting collection of 59 beetles from S. Wales, chiefly from the Tenby district. The species include 1 *Hister neglectus*, 6 *Pachylopus maritimus*, 2 *Kissiter minima*, and 1 *Cassida sanguinolenta*.

1912.—(4) One hundred and thirty-three beetles (including a number of rare northern species, e.g., *Criocephalus rusticus* and the black form of *Carabus arvensis*) a few taken in 1910; also 30 insects of various Orders, including a series of 5 Empid flies with their prey. The insects were collected in many localities in several of the Scottish counties and the Isle of Eigg, in S. Wales, Cheshire, Norfolk, Kent, Sussex, Surrey, and S. Devon.

1911.—(5) Two hundred and forty-one Coleoptera, 8 Hemiptera, and 1 Homopteron from Aberdeenshire, Co. Meath, and a number of Southern English Counties (1900-10). The beetles include 74 species additional to those previously given by the donor, with such interesting forms as the Northern *Elaphrus lapponicus* (including black var.) and *Anchomenus ericeti.*

(6) Six Empid flies, *Tachista* sp., from Tubney, near Oxford.

1907.—(7) Forty-four insects, chiefly Aculeate Hymenoptera, from Deal.

The following valuable additions to the British collections are due to the generosity of F. C. Woodforde:—

(1) New Forest and neighbourhood, many localities—111 butterflies, 344 moths, including 7 bred *Notodonta trepida*, 1 *N. chaonia*, 9 *Zygaena meliloti*, 4 *Sesia asiliformis*, and 1 *Phalera bucephala* with R. hind wing malformed; 29 Parasitic Diptera, viz. 11 Tachinids, bred from *Asphalia ridens* and 1 from *Bombyx rubi*, 17 of the huge *Echinomyia grossa*, bred from *B. rubi*. Pupa-cases both Dipterous and Lepidopterous are included. Nine *Tabanidae* and 1 *Hippobosca*. Three Phorid flies bred from larvae seen by A. H. Hamm emerging from the body of *Z. meliloti* which had been killed about July 12 with ammonia, so that eggs had probably been laid by the parent fly in the body of the dead moth at some later date. Seven insects of other orders.

(2) Freshwater, Isle of Wight—2 butterflies, a fine series of 120 Noctuid moths.

(3) N. Devon—28 butterflies, including 6 *Leucophasia sinapis* and 2 *Thecla betulae*, 9 moths; also a butterfly *Pararge egeria* and a moth *Arctia villica* with injuries to both hind wings almost certainly caused by birds; 3 Ichneumonids, with their cocoons, from a pupa, probably of the moth *Gortyna flavago*, found in a thistle-stem.

(4) Eight *Endromis versicolor* bred Mch.—Apr., 1913, in the New Forest, from parents bred in 1912 from a S. English male and Scotch female (1911). Also ova from the 1912 female parent, and 2 pupae (Aug. 1912) of her offspring.

(5) Cocoons of the following moths:—3 of *B. rubi* (May, 1913) from New Forest larvae (Oct. 1912); 1 of *N. trepida*; 1 of *Bombyx castrensis* (Aug. 1913) from larvae collected in Sheppey Isle by Commander J. J. Walker.

The British Lepidoptera have been greatly enriched by 255 butterflies and 465 moths, including a few pupae and cocoons, from the Tiverton district and also from many localities in Cornwall, Warwickshire, Northamptonshire, Huntingdonshire, Herefordshire, Isle of Wight, Sussex, Cambridgeshire, and Kent——B. G. Adams. The specimens, of which the great majority were captured 1911-13, include fine series of the following butterflies—*Vanessa c-album*, *Melitaea cinxia*, *M. athalia*, *Lycaena arion*, *Thecla betulae* (bred), *Carterocephalus palaemon*, and of the following moths—*Macroglossa bombyliformis*, *Aplecta advena*, *Hydrelia uncula*, *Phorodesma pustulata* (*bajularia*), *Lobophora viretata* (bred), *Epione apiciaria*, *Yponomeuta cognatellus* (bred).

Three dark forms of *Agriopis aprilina*, bred Oct., 1911, by F. Littlewood at Kendal, Westmoreland——T. A. Chapman, M.D. Also a preparation shewing the remarkable anterior leg of this species, and a Syrphid fly, Reigate (1910).

A female *Sirex gigas* captured at Hambleden, Henley-on-Thames, 1913, by Florence Furness——T. D. Acland, D.M., Ch. Ch.

Ten of the minute beetles *Cis pygmaeus*, from fungus, Sandown, I. of W.——C. J. C. Pool.

A male *Gonepteryx rhamni* shewing excessive wear after hybernation, Crowborough, Sussex——E. R. Speyer.

Two cockroaches *Leucophaea surinamensis*, in old greenhouses, Bradford (1912)——F. Rhodes.

The Noctuid moth *Bryophila glandifera*, 23 from walls of various colours, Paignton (1912-13)——R. C. L. Perkins, D.Sc., M.A., Jesus. The moths shew great variation, but there was no evidence of the selection of specially suitable surfaces.

The following insects, unless otherwise stated, were captured in the Oxford district, and in the year 1913:—

Presented by Commander J. J. Walker:—(1) A Syntomid moth *Ceramidia* sp. near *chloroplegia* found alive in

a fruit-shop at Summertown near Oxford. It is probable that the cocoon had been imported in bananas from Jamaica, see Proc. Ent. Soc., 1913, p. lxx.; (2) 1 *Sirex gigas*, Market Street; 1 Locustid, *Platycleis brachyptera*, Woking; a male and female of the very local moth *Clisiocampa castrensis*, bred at Harwich by F. Kerry (1879); 1911.—(3) 6 insects from various localities including 2 Cyrtid flies from Cothill, nr. Abingdon.

The Noctuid moth *Hydroecia petasitis*, in spider's web, wall of Wadham College, Warden's Garden (Sept. 11, 1900)——A. H. Hamm. The first record of this species in the Oxford district: a second example has since been taken.

The following additions to the bionomic series——A. H. Hamm:—the Diptera *Volucella bombylans*, v. *mystacea* from a spider's web, and *Empis tessellata* attacked by a sparrow; *Vespa germanica* with its prey a male *Bombus* sp., probably *terrestris*; the bees *Bombus lapidarius* and *Anthophora pilipes* injured evidently by birds.

The following beetles and moths including rare and interesting species——Joseph Collins, of the Hope Department:—2 *Haemonia appendiculata*, from the Cherwell at Gosford, 4 *Nemasoma elongatum*, Water Eaton; also 2 Proctotrupids from the runs of *Hylesinus vittatus*, Water Eaton, evidently parasitic upon it or its parasite, the before-mentioned *Nemasoma*; the moths, 1 *Panolis piniperda* and 2 *Cucullia verbasci* bred from larvae, Tubney (1912).

A pair of *Bombus lapidarius*, in cop., and 3 *Oxypterum pallidum*, a Dipterous parasite, from young Swift, Museum grounds; 1 Hemipteron and 1 Staphylinid beetle, Park Town; 1 *Corymbites cupreus* v. *aeruginosus* and 2 *Geotrupes sylvaticus*, Cheviots——R. S. Bagnall.

Twenty-four moths, including a series of *Anchocelis pistacina* and *A. lunosa* and 1 *Phigalia pedaria*, from Shrewsbury and Oxford——W. J. von Monté Pendlebury, Keble.

For the bionomic series:—*Vespa vulgaris* with Dipterous prey, Aberdeenshire; *Empis tessellata* with moth prey, and

the Dipterous prey, *Leptis scolopacea* of another *E. tessellata* (lost), Tubney, near Oxford——E. A. Cockayne, M.A., D.M., Balliol.

One Odonate and a Tipulid, near Abingdon——Rev. C. F. Thornewell.

The White Plume moth, *Aciptila pentadactylus*, Tackley Place——W. Stone.

The Geometrid moth, *Amphidasys betularia*, Park Town ——the Professor.

Sirex gigas, Lonsdale Rd., Oxford——Mrs. Pogmore.

A Queen *Vespa germanica*, Univ. Observatory (Apr. 3) ——Professor H. H. Turner, D.Sc., M.A., New College, F.R.S.

Plusia moneta, at light, Museum Rd.——H. Eltringham.

The green cockroach *Panchlora viridis*, in bunch of bananas, Henry Rd.——A. Gillam.

The Longicorn beetle *Clytus arietis*, on Acacia bark, Bevington Rd.——P. Bartholomew.

A large Lycosid spider, an accidental importation, found alive by a boy—purchased for the Department.

Additions to the Collections in 1914.

The accessions are arranged geographically as in 1912 and 1913.

A fine collection of 733 butterflies, South Africa—— G. B. Longstaff. The *Satyrinae* (189) and *Lycaenidae* (268) were especially rich, the former including a new form, *Pseudonympha detecta*, described by Roland Trimen, F.R.S., in Ent. Monthly Mag., 1914, p. 281. The specimens were captured in many localities near Cape Town, Caledon, Knysna, George, and East London, and the dates range from Jan. 7 to Apr. 9.

Thirty-five butterflies and 5 moths (*Urania*) from Ambatoharanana and the adjacent Ambohimanga, Imerina, Central Madagascar —— Rev. J. U. Yonge, M.A., Keble. This little collection, which is very welcome,

includes a pair of each of the following species captured *in cop.*:—*Papilio epiphorbas, Strabaena tamatave, Belenois antsianaka.* Of the last-named species several specimens are present, together with a female of the rare *Ptychopteris lucasii*, 2 *Belenois helcida*, 1 *Precis eurodoce*, 2 *P. epiclelia*, 1 *P. andremiaja* (dry season form). The Uranias were part of a set of 7, of which 5 were females, captured together Jan. 8.

Fifty-two specimens, part of a family raised from the eggs of a typical female of *Acraea encedon*, Durban, Natal ——E. E. Platt. Thirty-two of the specimens were of the *encedon* form and 20 of that yellowish form of *lycia* known as *sganzini*. Males predominated over the females as they did in W. A. Lamborn's Lagos families in which both sexes were represented, thus rendering it probable that all-female-producing strains of female exist in S.E. Africa as they had been proved to exist in the W. Although the offspring segregated completely into the two above-mentioned forms the individuals of both sets exhibited distinct variation in the presence or absence and degree of development of a spot in area 2 of the fore wing. The specimens were exhibited at the Ent. Soc., Mch. 17, 1914. Further interesting butterflies bred in the Durban district by the same kind donor are:—7 *Amauris albimaculata* from a single batch of eggs, 13 *A. ochlea* together with their female parent, 2 *Antanartia schaeneia*, 5 *Myrina dermaptera*. All are welcome additions to the University collection.

Two examples of the hawkmoth *Deilephila livornica*, at electric light on H.M.S. *Diadem*, Suez Canal, near Ismailia (Feb., 1903)——J. J. Walker.

Six Syntomid moths of two species, bred 1907-8 in the Durban district by Miss M. E. Fountaine——H. Rowland-Brown, M.A., University.

An example, unfortunately in poor condition, of the mimetic *Acraea althoffi pseudepaea*, Odumassi, 35 miles S. of Kumassi (1904-5)——H. Eltringham. This rare sub-

species, new to the collection, is of great interest, inasmuch as the species assumes a different pattern in Uganda in mimicry of other Planemas.

Two examples of the rare mimetic African Lycaenid butterfly *Mimacraea marshalli* and a male and female of the rare Jamaican *Papilio homerus* were also presented by the same kind donor, together with the following rare moths:—1 *Cocyta durvillei* (Gilolo), 1 *Miliona sarawakensis*, 2 *Eudemonia brachyura* (Sierra Leone), 1 *Urania croesus*, 2 *Oenetus rubroviridans* (Queensland).

An Asilid fly, *Promachus* sp. and its prey, the male of *Delias descombesi*, Takdah, Sikkim, 5000 ft. (Aug. 18)——T. D. Broughton. The great relative size of the prey is of interest. The specimens were exhibited at the Ent. Soc., Mch. 17, 1914.

An interesting set of over 300 insects and 5 Arachnids from Java (1871-88) were presented by Miss Balfour. The specimens, probably of native capture in the neighbourhood of Batavia, formed the collection of the late C. Balfour. They include nearly 200 butterflies, 94 Coleoptera, and relatively small numbers of several other groups. Two mimetic associations from among the butterflies have been added to the bionomic collections—the dark forms of *Danaida* which are characteristic of Java and their models, and a female of the Javan form of *Papilio polytes* with its *Pharmacophagus* model. The beetles include 9 examples of the extraordinary form *Mormolyce*.

An interesting Geometrid moth with a conspicuous red and black pattern on the under surface of the wings, from British N. Borneo (July, 1892)——J. J. Walker.

One hundred and thirteen separate Coleoptera or mounts with two or more specimens, Celebes (1895-6)——Charles Hose.

Over 100 insects of various groups, the neighbourhood of Healesville, Victoria (1913-14)——Dr. A. Eland Shaw. The series includes 25 pupa-cases of the Pierine butterfly *Delias harpalyce* attached to the web spun by the larvae

over the food plant, *Loranthus*, together with 10 males and 5 females which emerged; also 48 moths, among which are interesting Cossids and Hepialids.

A male specimen of the rare hawkmoth *Trogolegnum pseudambulyx*, Hidalgo, Mexico (9000 ft.), a locality now inaccessible——B. Preston Clark.

An interesting series of 57 butterflies of several groups from the Tolima Range (5000—9000 ft.) and the Muzo district (3500 and 5000 ft.) of Colombia——W. K. Pomeroy. Many of the species are new to the Hope collection and all are very welcome because of the localities and the precision of the data.

More than 1500 European butterflies from the fine collection of the late Rev. H. C. Lang——H. Rowland-Brown. The specimens, which are accompanied by the most excellent data, were captured in the following countries—Switzerland (809), France (180), Spain (120), Corsica (76), Austria (69), Germany (87), Belgium (119), England (60, almost exclusively from Essex). They form a very welcome addition to the European species in the collection.

Two males and 2 females (*bryoniae*) of *Pieris napi* from the eggs laid by a *bryoniae* captured (June, 1911) in Lapland by W. G. Sheldon——Hugh Main, who had reared the insects (Apr., May, 1912) at S. Woodford, N.E.

Additions to the British Collections in 1914.

Fifty-five butterflies and 506 moths with few exceptions captured or bred in 1914 from larvae found at various localities in the New Forest——F. C. Woodforde. The series includes 29 *Z. meliloti*, 5 *N. chaonia*, 9 *A. ridens*, 15 *Leucania turca*, 5 *Heliothis dipsacea*, 11 *T. variata*. A series of 25 *Taeniocampa gracilis* bred from larvae on Myrica Gale and sallow apparently support the conclusion that the colouring of this species is influenced by the food plant; but further experiments with larger numbers are required. Three *Lycaena aegon* were added to the

general collection, and a male *Argynnis paphia*, injured probably by some insectivorous bird, to the bionomic series. Among the specimens outside the New Forest are 2 males and 1 female of the rare moth *Bombyx trifolii*, bred (Aug., 1914) from Bournemouth larvae.

The collection of British Lepidoptera has been further augmented by the following specimens captured or bred from larvae in New Forest localities by the same generous donor:—2 *Oporabia dilutata*, 1 *Eupithecia indigata*, 5 *Thera variata*, 5 *T. obeliscata*, 3 melanic *Boarmia abietaria*, 14 *Sarrothripus undulanus*, 10 *Z. meliloti* (for the general collection); also Hymenoptera Parasitica, many accompanied by their cocoons, from (1) the larva of *Poecilocampa populi*, (2) a Noctuid larva, (3) the larva of *T. variata* or *obeliscata*, (4) a Lepidopterous and (5) a Coleopterous larva.

Ten butterflies and 272 moths, including 5 *Dianthoecia irregularis*, 4 *D. caesia*, and 7 *Polia xanthomista*——E. D. Bostock. This fine series was collected at many localities in Staffordshire (1910—12), N. Wales (1902, 1908), I. of Wight (1890, 1913), also at Folkestone (1893), Arlington, Sussex (1911), Reading (1895), Wicken (1908—11), Hoylake (1894), I. of Man, Rannoch (1884), Aberdeen.

Four bred *Papilio machaon*, 4 *Lycaena corydon* v. *semisyngrapha* (Hertfordsh., 1913), and 291 moths, including 1 *Zygaena achilleae* new to the Hope Collection, 24 *Z. exulans*, 2 *Callimorpha dominula* with yellow instead of the usual red hind wings, 8 *Pachnobia hyperborea*, 12 *Dianthaecia irregularis*, 2 *Nonagria sparganii*, 12 *Gnophos obfuscata*, and 6 melanic *Odontopera bidentata*——B. H. Crabtree. This fine series was collected or bred from localities in Lancashire, I. of Wight (1894, 1908), also at Dorking, Deal (1900), Compton (Berkshire), Tuddenham, Suffolk (1889), Cambridge (1890), Huddersfield (1913), Delamere Forest, Cheshire (1902—1911), Manchester (1904), Seascale, Cumberland (1910), near Lake Windermere (1908, 1910), I. of Lewis (1901), Rannoch (1887, 1890), Braemar (1914).

Two hundred and forty-seven moths, including 7 *Tapi-*

nostola elymi, 1 *Triphaena comes* (*subsequa*), 3 *Agrotis pyrophila*, 13 *A. ashworthii*, 5 *Dasypolia templi*, 3 melanic forms of *O. bidentata*, 41 local forms of *Boarmia repandata* from Worcestershire, Devon, Kent, Cheshire, Lancashire and N. Wales, 20 *Oporabia filigrammaria*, 1 *Macaria liturata* var. *nigrofulvata*, 5 *Acidalia contiguaria*, 1 pink var. of *Hyria auroraria*——C. F. Johnson. This fine series was collected at localities in Kent (1906), the New Forest (1902-11), Devon (1908), Worcestershire (1905-11), Huntingdon (1908), Staffordshire (1903), Shropshire, Derbyshire (1910), Yorkshire (1896), Lancashire (1910-13), Cheshire (1893, 1909), Carnarvonshire (1909-12), Argyll (1905-6), Aberdeen (1892).

One hundred and sixty-four butterflies, including 16 *G. C-album* and 9 *L. sinapis*, and 63 moths, including 3 *Lasiocampa quercifolia*——A. B. Farn. This fine series was collected at localities in Kent (1901), Gloucestershire (1894), Monmouthshire (1913), Herefordshire (1912), Lancashire (1901), Cumberland (1900), Westmoreland, and Carnarvonshire.

Eighty-five butterflies and 78 moths, for the most part captured or bred from larvae taken at localities in Devon ——B. G. Adams. The butterflies include 11 bred *T. betulae*, 13 *Melitaea athalia* (Kent, 1910), 18 *G. C-album* (Wye Valley, 2 bred 1912, 16 captured 1914, of which 4 were added to the general collection). The moths include 28 *Callimorpha dominula*, 6 bred *Psilura monacha* (Wye Valley), 6 *Xanthia flavago* (*silago*), 2 *X. fulvago* (*cerago*) v. *flavescens*, 22 bred *Acronycta tridens*, 8 *Coremia designata* (*propugnata*) and 6 *Eupithecia pusillata* (New Forest).

Ten fine examples of the rare moth *Dianthoecia barrettii*, v. *fickleni* from the Bude district (1914)——H. Bernard Smith.

Fifty-two moths——J. Peed. The following interesting species are included:—10 *Brephos notha*, 6 *Senta maritima*, 18 *Coenobia rufa*, 4 *Toxocampa craccae*, 2 *Stilbia anomala*, 6 *Eupithecia extensaria*. These moths were captured or

bred from larvae taken at Cannock Chase (1905), Worcester (1906), Whittlesey (1912), nr. Bude (1906), Hunstanton (1912). The series also includes, from Unst, Shetland (July 23—31) 1 *Charaeas graminis*, 2 *Noctua festiva* v. *conflua*, 1 *Agrotis strigula* (*porphyrea*), 1 *Crymodes exulis*, and 1 *Melanippe montanata*.

Eighty-three moths, including 7 *Lithosia caniola*, 2 *A. ridens*, and 9 *Agrotis obelisca*, from the New Forest (1899) and Torquay (1897)——Rev. G. Hughes.

The following Lepidoptera, etc.——Commander J. J. Walker:—from Sheppey, 6 *Pyrameis cardui* (1899), 13 *Arctia villica* bred (10 in 1913 by donor, 3 in 1908 by H. Brown) from eggs laid by a female from Queenborough, 4 *Eremobia ochroleuca* (1913), 1 *Leucania favicolor* (Captain J. J. Jacobs, 1908); from the Oxford district—6 *P. moneta* (bred 1907), 1 *Oporobia dilutata*, 3 *P. cardui* and 1 *Panorpa* (Cothill), 15 *Galleria melonella* (the 'Honey-comb moth') bred by H. R. Best, Summertown; from Unst, Shetland—2 *Noctua glareosa* var. (J. J. F. X. King, 1895).

Fifteen specimens from one colony of *Zygaena trifolii* on E. Dartmoor (1000 ft.) and 17 from another about 200 yards distant (June)——R. C. L. Perkins. The specimens are of much interest inasmuch as the two series exhibited a difference in average size, in pattern, and, in some individuals of one colony, in colour. Difference had been observed in previous years. Dr. Perkins also presented 18 individuals from a colony of *Parasemia plantaginis* captured June 1 on the bare slope of a hill near Cerne Abbas, Dorset. The 9 females are none of them typical, having less black in the fore wings and hind wings more like those of the male than is usual in this species. These interesting examples of local variation were exhibited to the Ent. Soc., Nov. 4, 1914 (Proc., p. xcv.).

Thirty-nine moths——Joseph Collins. The following interesting species are included:—2 *Cucullia asteris* (bred 1906 from Sheerness larvae), 1 *C. lychnitis* (bred 1909 from Streatley), 2 *P. moneta* (bred 1902 from Kent), 9 *P.*

festucae (bred 1902 from Warrington); also from Lancashire 2 *Agrotis cursoria* (1896), 6 *Hydroecia lucens* (1901), 12 *Carsia paludata* (1903).

An interesting dark var. of *Argynnis selene*, Crowthorne, Berkshire (June, 1913)——Rev. C. F. Thornewill.

An Asilid fly with its prey, a moth, Royston, Herts. (Aug. 3)——E. A. Cockayne.

The moth *Aphomia colonella*, near Stroud (June 28)——H. Eltringham.

The following specimens were captured, unless otherwise stated, in the Oxford district and in the year 1914.

Thirty moths with the pupa-cases of 3 of the specimens ——A. H. Hamm. The series includes 13 *Zygaena lonicerae* of which 2 were added to the general collection, and 5 *Toxocampa pastinum*. Mr. Hamm also presented 8 males of the ant *Formicoxenus nitidulus* and 4 males of the fly *Ceratopogon formicarius*, captured on the mound of *Formica rufa* at Bournemouth, Aug. 6 (Proc. Ent. Soc., 1914, p. c.).

Fifteen examples of the Noctuid moth *T. pastinum*, captured in N. Berkshire (July, 1913)——S. Galpin.

A hybernating Peacock butterfly (*Vanessa io*), the Hall staircase, Keble (Feb. 6)——W. J. von M. Pendlebury.

A male of the Poplar hawkmoth (*Smerinthus populi*), on the wall of the University Museum (May 10)——H. Britten, of the Hope Department.

An example of the beetle *Silvanus surinamensis* found (Dec.) in a new and unused drawer of one of the standard cabinets in the Department——the Professor.

THE HOPE LIBRARY: ADDITIONS IN 1913 AND 1914.

Mr. R. S. Bagnall drew up an account of the accessions in 1913 to which those of 1914 have been added by the Professor. Reports or other publications in 1913-14 of the following institutions, &c., have been added to the

Library. All have been presented except those marked * (given by the Professor), † (received in exchange), and ‡ (purchased).

*Academy of Natural Sciences of Philadelphia: Reports.

*Annals of Applied Biology (1914).

American Entomological Society, vols. xx.—xxv. (1893-98) and xxx.—xxxiv. (1904-08). (In part purchased).

Bombay Natural History Society.

Bristol Museum and Art Gallery.

British Museum, Trustees of the:—

Catalogue of the Lepidoptera Phalaenae in the British Museum, vols. xii. and xiii. with supplementary vols. of plates, by Sir George F. Hampson.

A Revision of the Ichneumonidae, pts. II. and III., by Claude Morley.

Guide No. 6, illustrating animal flight.

*Bulletin of Entomological Research.

Cambridge University, Reports of Zoological Department.

†Canada: publications on the subjects of the Hope Dept., issued by the Dept. of Agriculture and especially the Division of Entomology.

†Colombo Museum, Ceylon: Spolia Zeylanica, vols.: Administration Reports.

*Chester Soc. Nat. Sci. Lit. and Art.

†Deutsche Entomologische National-Bibliothek.

†Deutsche Entomologische Zeitschrift.

Dove Marine Laboratory.

Durban Corporation Museum.

Egypt: Report of the Zoological Service.

*Entomological Society of London. Another set, for the Lepidoptera Room, bound uniformly with the rest of the series, presented by G. A. James Rothney.

†Entomologisk Tidskrift, Stockholm.

‡Entomologist.

‡Entomologist's Monthly Magazine.

‡Entomologist's Record.

Études de Lépidoptérologie comparée: the splendidly

illustrated volumes for 1913-14. Presented by M. Charles Oberthür.

Federated Malay States Museums.

*Imperial Bureau of Entomology: Reports.

India, Fauna of British:—Hymenoptera, vol. iii., (Ichneumonidae) pt. I., by Claude Morley; Orthoptera (Acridiidae) by W. F. Kirby. Presented by the Secretary of State for India in Council.

Indian Museum, Calcutta: Records, Memoirs (including a monograph on Echinoidea by René Kœhler of Lyon), Reports, and an account of the Institution (1814—1914).

Instituto Oswaldo Cruz, Rio de Janeiro: Memorias.

*Lancashire and Cheshire Entomological Society.

Lancashire Sea-Fisheries Laboratory.

‡Lepidopterorum Catalogus, Wagner, Berlin.

*Linnean Society of London.

Maine, University of: Agric. Exp. Stat., Orono.

Manchester University: Zoological Dept.

Marine Biol. Assoc., W. of Scotland.

*Marine Biol. Assoc., U.K.

Michigan Academy of Science.

*New York Acad. Sci.: Annals.

Novitates Zoologicae: Tring Zool. Museum. Presented by Lord Rothschild, F.R.S.

*Oxford: Transactions (1913) and Proceedings (1914) of the 2nd International Congress of Entomology, August, 1912.

Pennsylvania University: Zoological Laboratory.

Radcliffe Library: Catalogue of Additions.

‡Ray Society.

*Real Sociedad Española de Historia Natural.

*Review of Applied Entomology.

Rhodesia Museum, Bulawayo.

Royal College of Surgeons.

Sarawak Museum.

Scottish Marine Biol. Assoc.

*Société Entomologique de Belgique.

*Société Entomologique de France.

†Société Entomologique Suisse.

*South London Entomological and Natural History Society.

United States: publications on the subjects of the Hope Dept. issued by the Dept. of Agriculture and especially the Bureau of Entomology, including an account of the principal Cactus Insects of the United States, by W. D. Hunter, F. C. Pratt, and J. D. Mitchell; a well illustrated Classification of the Aleyrodidae, by A. L. Quaintance and A. C. Baker; and Bull. No. 91, on the Importation into the U.S. of the parasites of the Gipsy Moth and the Brown-Tail Moth, by L. O. Howard and W. F. Fiske.

United States National Museum, Washington: papers on the subjects of the Hope Dept. by the following authors:—C. P. Alexander (2 papers), L. Bruner (2), Aug. Busck, A. N. Caudell (3), A. H. Clark, T. D. A. Cockerell (5, one with H. L. Viereck), J. C. Crawford (6), A. A. Doolittle, H. G. Dyar (7), H. T. Fernald, J. W. Folsom, A. B. Gahan, A. A. Girault, F. Knab (2), J. R. Malloch (8), A. C. Morgan, P. R. Myers, A. S. Pearse, W. D. Pierce, Mary J. Rathbun (4), Harriet Richardson (2), S. A. Rohwer (5), W. Schaus, H. L. Viereck (6), P. E. Wasmann S. J., H. F. Wickham, C. B. Wilson.

‡Zoological Record.

The following Authors have presented their publications to the Library. Those presented in 1913 are undated, in 1914 dated, in both years undated but with the sign + separating the donations of the two years.

Chr. Aurivillius: 8 papers on Coleoptera.

A. W. Bacot (1914): 5 papers (one in conjunction with Dr. C. J. Martin, F.R.S., and another with W. G. Ridewood).

R. S. Bagnall: 13 papers, chiefly on Thysanoptera and Myriapoda.

Prof. G. S. Brady, F.R.S.: A valuable series of 20 + 2

papers on Crustacea including two monographs in collaboration with Rev. Canon A. M. Norman, F.R.S.

Malcolm Burr, D.Sc. (New College): 5 + 7 papers on Dermaptera (one in conjunction with Dr. K. Jordan).

Dr. G. W. Hale Carpenter: 3 papers including 2 reports on the Bionomics of *Glossina fuscipes* (*palpalis*) of Uganda.

T. L. Casey: Memoirs on the Coleoptera, pts. IV + V.

Filippo Cavazza (1914): Influenza di agenti chimici sullo sviluppo, metamorfosi e riproduzione del *Bombix mori.*

Dr. T. A. Chapman, M.D.: A valuable set of 79 + 17 papers (one in conjunction with G. T. Bethune-Baker).

W. E. Collinge (1914): 5 papers on Isopoda.

Capt. F. W. Cragg, M.D., I.M.S.: 3 pts. (2 to 4) Studies on the Mouth Parts and Sucking Apparatus of the Blood-Sucking Diptera. Also in conjunction with Capt. W. S. Patton, M.B., I.M.S., two memoirs on Indian biting flies.

W. C. Crawley (1914): 8 papers on Ants.

H. St. J. K. Donisthorpe: 6 + 3 papers on Ants and Myrmecophiles (one in conjunction with W. C. Crawley).

H. T. Fernald (1914): 4 papers including 3 Reports from the Mass. Agric. Exp. Stat., Amherst. Also a paper on N. American *Scoliinae*, by O. C. Bartlett.

Katharine Foot and E. C. Strobell (1914): 3 papers on the crossing of the Hemiptera *Euschistus variolarius* and *E. servus*, with a discussion of the bearing of the results upon theories of the chromosomes in relation to heredity.

Prof. G. Gilson (1914): Le Musée d'Histoire Naturelle Moderne, sa Mission, son Organisation, ses droits, Brussels, 1914. A beautifully illustrated monograph.

F. H. Gravely, M.Sc.: 1 + 1, the latter an important monograph on the Oriental *Passalidae.*

Dr. J. L. Hancock: 14 papers chiefly on *Tetriginae* (Orthoptera).

Dr. Anton Handlirsch (1914): 6 papers, chiefly on fossil insects.

Dr. R. Hanitsch (1914): Guide to the Zoological Collections of the Raffles Museum, Singapore.

Glenn W. Herrick: 6 papers on Economic Biology.

J. Douglas Hood: 2 + 9 papers on Thysanoptera.

Dr. B. Daydon Jackson, Ph. D.: Catalogue of the Linnean Specimens of Amphibia, Insecta, aud Testacea noted by Carl von Linné.

Prof. Vernon L. Kellog (1914): A valuable series of 27 papers on ecto-parasites of Vertebrata, especially the Mallophaga parasitic on birds, including 5 written in conjunction with J. H. Paine, 2 with W. M. Mann, and 1 with S. Nakayama, 1 with S. I. Kuwana, 1 with B. L. Chapman, and 1 with the latter and R. E. Snodgrass. In addition to this series 1 paper by the last-named author.

Stefan Kopec: 3 papers (1911-12), including "Untersuchungen über Kastration und Transplantation bei Schmetterlingen." (1911).

Prof. Aug. Lameere: A further part of his "Revision des Prionides".

R. P. Longinos Navás, S.J.: A valuable series of 11 + 16 papers chiefly on Neuroptera and including a Sinopsis of the *Ascalaphidae.*

W. Schaus: 11 papers on Neotropical Lepidoptera. (1912-13).

Prof. W. Morton Wheeler: A valuable set of 16 + 5 papers on Ants (one in conjunction with W. M. Mann).

Original papers, generally published in 1913-14, but a few in 1912 or earlier dates, have also been presented by the following Authors—(papers presented in 1913 and 1914 are separated by +):—E. W. Adair; W. C. Allee; N. Annandale, D.Sc. (2 + 1); E. E. Austen; A. Avinov; F. Balfour-Browne, M.A.; F. J. Ball; F. A. Bather, F.R.S. (1 + 2); Prof. T. Hudson Beare; G. T. Bethune-Baker; Dr. Ignacio Bolivar (2, one with C. Ferrière, B.Sc.); H. H. Brindley, M.A.; P. A. and D. A. J. Buxton; A. E. Cameron; G. H. Carpenter and T. R. Hewitt; A. N,

Caudell; T. D. A. Cockerell (5); Prof. F. J. Cole; W. P. Curtis; Prof. A. Dendy, F.R.S.; Dr. J. Dewitz (2); Dr. A. Dampf (4); L. Doncaster, M.A. (1 + 2, one with J. W. H. Harrison); J. H. Durrant; Dr. Harrison G. Dyar (3); Prof. C. Emery (2); F. M. de la Escallera; Dr. A. Forel; J. C. F. Fryer (2); Dr. R. Gestro; E. E. Green; Sir George Hampson; Dr. Ross G. Harrison (2); Dr. C. Gordon Hewitt (2 + 3); Prof. S. J. Hickson, F.R.S.; W. E. Hoyle and Clara Nördlinger; Rev. J. E. Hull; N. Ikonnikov; Dr. A. D. Imms, D.Sc. (2); Prof. Tokutaro Ito; Charles Janet (2); J. W. Haigh Johnson and H. M. Wilson; Rev. F. W. Johnson; W. J. Kaye; R. Kelly; J. C. Kershaw; G. C. Lamb; Prof. H. Maxwell Lefroy; Dr. G. B. Longstaff; W. S. Marshall; Dr. C. J. Martin, F.R.S.; Dr. C. S. Minot; F. Muir and J. C. Kershaw; Prof. R. Newstead, F.R.S.; A. d'Orchymont (3); W. Dwight Pierce; N. M. Richardson (presented by Mrs. E. R. Bankes); Hugh Scott, M.A. (2 + 3); C. M. Selbie, B.Sc. (2); Capt. R. B. Seymour Sewell, B.A., and B. L. Chaudhuri, B.Sc.; L. Sitowski; Eland Shaw; T. Shiraki (2); K. Simm; Yngve Sjostedt (3); Dr. H. Skinner; Geoffrey Smith and A. H. Hamm: Rev. T. R. R. Stebbing, F.R.S. (1 + 3); G. Storey and Dr. L. H. Gough; C. Strickland, M.A.; C. F. M. Swynnerton; W. M. Tattersall and T. A. Coward; F. H. Taylor (1 + 1); F. V. Theobald; D. G. Tower, B.Sc. (2); Ivar Trägardh; Dr. F. von Tubeuf; Anna Valenti; G. H. Verrall (ed. J. E. Collin); H. Viehmeyer; H. J. Waddington; Dr. Einar Wahlgren; Rev. J. Waterston, B.Sc.; J. H. Watson; F. M. Webster and T. H. Parks; Rev. G. Wheeler.

Important accessions to the Library have been presented by the following donors (in 1913 when no date is given):—

R. S. Bagnall: 39 papers, including a series of 19 by Fr. Meinert (1884-96), a memoir on the Lac Insect by E. P. Stebbing (1910), Biological and Embryological Studies on *Formicidae* by M. C. Tanquary, 4 papers

on Chermes by C. Börner (1908-10), and two parts of the "Fauna Hawaiiensis' (1910).

Delegates of the Oxford University Museum (1914): 12 papers on the subjects of the Department, issued by the U.S. National Museum, Washington; also Hymenoptera Aculeata, vol. i., pt. I, by R. C. L. Perkins and Auguste Forel, from "Fauna Hawaiiensis".

M. Hassan, Lincoln College (1914): 54 papers on the subjects of the Department, issued by the U.S. Nat. Mus., Washington.

Dr. G. B. Longstaff, M.A., D.M., New College: A Manual of New Zealand Entomology, by G. V. Hudson; Nature in New Zealand, compiled by J. Drummond and edited by Capt. F. W. Hutton, F.R.S.; A New Zealand Naturalist's Calendar by Geo. M. Thomson (1909); Noch Einmal Mimicry, Selektion Darwinismus, in 2 parts by M. C. Piepers (1903-07); Two papers on Insects Injurious to Cotton in Egypt by F. C. Willcocks (1906-7).

Prof. R. Meldola, F.R.S.: Die Farbenevolution (Phylogenie der Farben) bei den Pieriden (Leiden, 1898) by M. C. Piepers.

Paris, presented by the Minister of Public Instruction: Tome 10, Fasc. 1 (Entomology) of Mesure d'un Arc de Méridien Équatorial en Amérique du Sud, sous le Contrôle Scientifique de l'Académie des Sciences, 1899-1906.

Sir John Rhŷs: Four papers (1909-13) on Lepidoptera, by Count Emilio Turati (one in collaboration with R. Verity).

G. A. James Rothney: A set of 93 + 1 papers, chiefly on Hymenoptera, including valuable desiderata by A. Forel and P. Cameron.

Commander J. J. Walker, Hon. M.A.: A copy of the finely illustrated work "The Butterflies of Hongkong" by J. C. Kershaw.

Col. J. W. Yerbury (1914): 32 papers of various dates —some old and rare—chiefly on Diptera; also 13 volumes of the Entomologist's Monthly Magazine, and many parts

of other journals including 9 of F. W. Konow's *Zeitschr. f. syst. Hymenopterologie und Dipterologie*.

Two hundred and forty-one papers and volumes by various authors were presented by the Professor in 1913. The series includes:

A reprint of Linné's Systema Naturae (Ed. I., 1735).

Academy of Natural Sciences of Philadelphia, Proceedings, Mch. 19-21, 1912, in commemoration of the one hundredth anniversary of the foundation.

A part (vol. xiii., pp. 547-752, Trans. S.A. Phil. Soc., 1908) of Péringuey's Catalogue of South African Coleoptera; also 28 papers on Malacoderms (chiefly *Lycidae*) by J. Bourgeois.

Enzio Reuter's Über die Palpen der Rhopaloceren, Helsingfors, 1896. (This volume was presented to the late Dr. A. R. Wallace, F.R.S., and given by him to Prof. R. Meldola, F.R.S., who in turn handed it to the Professor.)

Dr. Yngve Sjostedt's Übersicht der ergebn. einer Zool. Reise in Kamerun West-Afrika 1890-92: the introduction to his Kilimandjaro-Meru Expedition and two parts on the Kilimandjaro-Meru Orthoptera.

In addition to the purchases already recorded, 21 of the older memoirs on insects published in the Trans. of the Linnean Society were bought in 1913, and The Genitalia of British Geometridae, by F. N. Pierce, in 1914.

E. B. POULTON.

THE HOPE REPORTS

VOL. X

APPENDIX

1904—1922

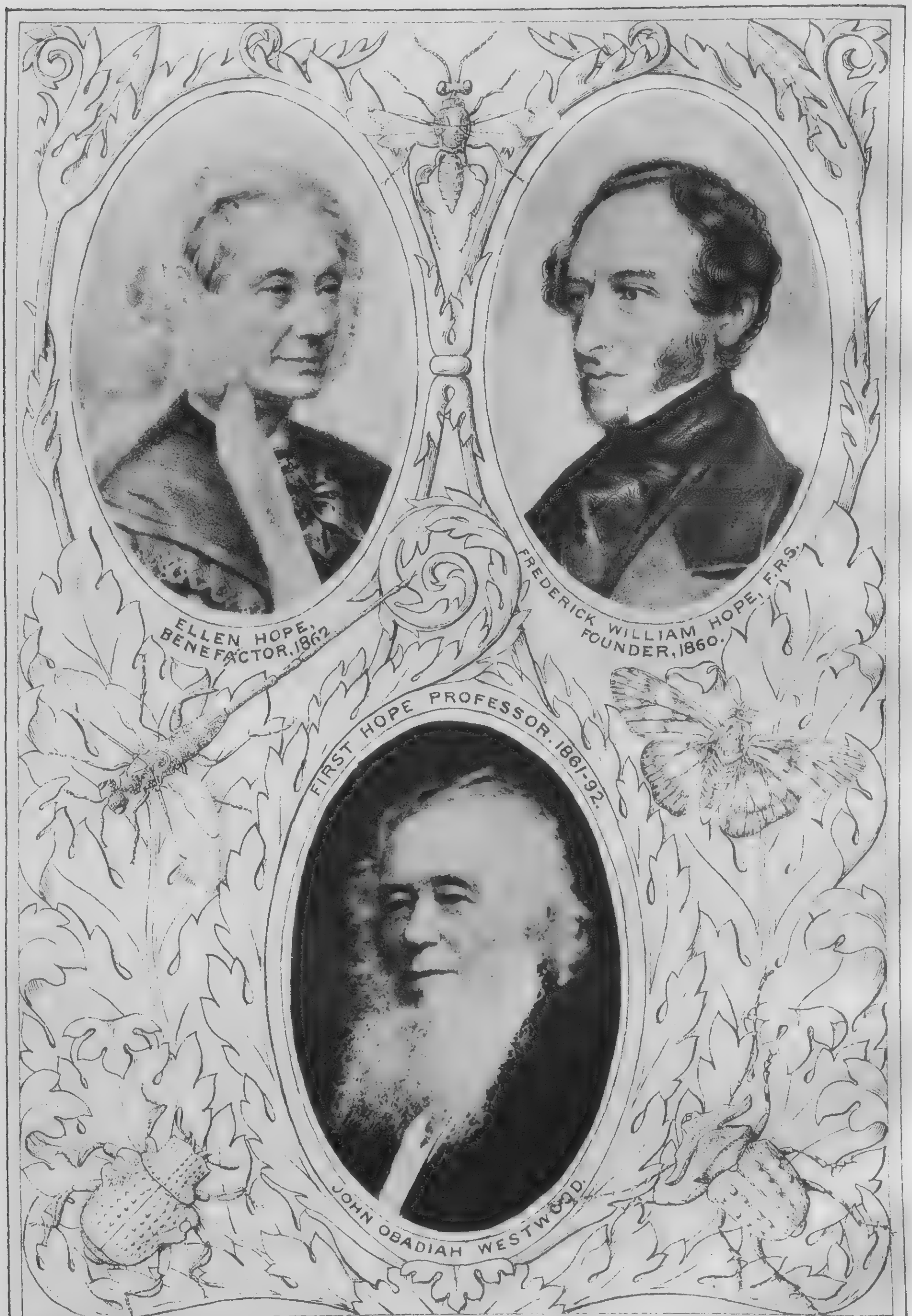
EDITED BY

EDWARD B. POULTON, M.A., D.Sc., Oxon., Sydney

HON. LL.D. PRINCETON, HON. D.Sc. DURH., DUBL., F.R.S., ETC.

HOPE PROFESSOR OF ZOOLOGY IN THE UNIVERSITY OF OXFORD
FELLOW OF JESUS COLLEGE, OXFORD
FOREIGN MEMBER K. SVENSKA VETENSK-AKAD., STOCKHOLM
MEMBRE HONORAIRE DE LA SOCIETE ENTOMOLOGIQUE DE BELGIQUE
SOCIO HONORARIO DE LA REAL SOCIEDAD ESPAÑOLA DE HISTORIA NATURAL
CORRESPONDENT OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA
HONORARY MEMBER OF THE ACADEMY OF SCIENCE, NEW YORK
CORRESPONDING MEMBER OF THE SOCIETY OF NATURAL HISTORY, BOSTON, AND
THE AMERICAN ENTOMOLOGICAL SOCIETY

OXFORD
PRINTED FOR PRIVATE CIRCULATION
1924



ALFD. ROBINSON, DEL.

THE MAKERS OF THE HOPE DEPARTMENT
OXFORD UNIVERSITY MUSEUM

THE HOPE REPORTS

VOL. X

APPENDIX

1904—1922

EDITED BY

EDWARD B. POULTON, M.A., D.Sc., Oxon., Sydney

HON. LL.D. PRINCETON, HON. D.Sc. DURH., DUBL., F.R.S., ETC.

HOPE PROFESSOR OF ZOOLOGY IN THE UNIVERSITY OF OXFORD
FELLOW OF JESUS COLLEGE, OXFORD
FOREIGN MEMBER K. SVENSKA VETENSK-AKAD., STOCKHOLM
MEMBRE HONORAIRE DE LA SOCIÉTÉ ENTOMOLOGIQUE DE BELGIQUE
SOCIO HONORARIO DE LA REAL SOCIEDAD ESPAÑOLA DE HISTORIA NATURAL
CORRESPONDENT OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA
HONORARY MEMBER OF THE ACADEMY OF SCIENCE, NEW YORK
CORRESPONDING MEMBER OF THE SOCIETY OF NATURAL HISTORY, BOSTON, AND
THE AMERICAN ENTOMOLOGICAL SOCIETY

OXFORD
PRINTED FOR PRIVATE CIRCULATION
1924

INTRODUCTORY NOTE.

Memoirs of royal octavo or small quarto size, which could not without injury be included in the regular series of Hope Reports, have been accumulating since 1904 and are sufficient, and perhaps more than sufficient, to fill the volume now issued as an appendix to X, just as the quarto memoirs were brought out in 1913 as an appendix to VIII. The earlier Appendix, however, contained but few memoirs, nearly all of which dealt with the *Blattidae*, and the contents were summarised by the addition of a few lines to the Preface of Vol. VIII. The present Appendix, on the contrary, contains 32 memoirs of the most varied kind and a separate introductory note becomes necessary.

Nos. 2—4 include the Presidential introductory and other addresses to the Second International Entomological Congress at Oxford in 1912, by the Professor. Of these, No. 2 gave an account of the Oxford material illustrating the most wonderful mimetic butterfly in the world, *Papilio dardanus*.

At this Congress it was decided to hold the Third International meeting at Vienna in 1915, and Professor Handlirsch, then with us in Oxford, was unanimously elected President, as referred to in No. 3. It is difficult to realize that this happened little more than twelve years ago, in a different world.

Memoirs 5—8 deal with Mimicry in Lepidoptera. No. 5, by Dr. F. A. Dixey, F.R.S., is an important general paper, covering a wide ground and quoting abundant examples, read before the First International Congress at Brussels in 1910. No. 6, by the Professor, read at the same meeting, gives an account of C. A. Wiggins' valuable work on Mimicry in the forest butterflies of Uganda. Of Nos. 7 and 8, also by the Professor, the first is a reply to the criticisms of a distinguished American naturalist, the second a brief discussion of mimetic resemblance between a moth and a butterfly in New Guinea.

No. 9 by C. F. M. Swynnerton, F.L.S., is a reply to the American naturalists who have argued that an examination of stomach-contents proves that birds are negligible as enemies of butterflies. This paper should be read with the author's communication in Hope Reports, Vol. XI, No. 5, b.5, and his important monograph in the Linnean Society's Journal—Zoology, Vol. XXXIII, June, 1919, p. 203, a memoir

I greatly wished to include in these Reports, but was prevented by the cost, which at the time had reached its highest.

Nos. 10—14 form a series of papers on heredity. Nos. 10 and 11 are two important memoirs on the inheritance of male characters in the Hemiptera. The separata were generously presented by the authoresses, Miss Foot and Miss Strobell, who, while carrying on their work in Oxford received much help from Dr. Eltringham. The death of Miss Strobell will be deeply regretted by all those who are familiar with the fruitful results of her collaboration with her friend and comrade in research.

No. 12, by the Professor, gives an account of the all-female and mixed families of a W. African butterfly, bred by W. A. Lamborn.

No. 13, by L. B. Prout and A. W. Bacot, and No. 14, by W. B. Alexander, deal with Mendelian Heredity in the moth *Acidalia virgularia*. The material forming the subject of these two memoirs was presented to the Department by the first two naturalists.

The recent death of Mr. Bacot in Egypt while investigating the conveyance of typhus by lice is a great blow to Zoological Science, especially to that important branch of it which, co-operating with medicine, seeks to alleviate human suffering. Before he began his important researches at the Lister Institute Mr. Bacot had for many years conducted experiments on variation and heredity in moths. The whole of the resulting material he presented to the Hope Department.

Dr. Dixey's account of the epigamic scent-patches of male Pierine butterflies is contained in No. 15, and notes, chiefly on the colour-changes of S. African chamaeleons, by the late Dr. Longstaff and the Professor, in No. 16.

The remaining papers, 17—33, treat of Systematics and Classification, the first two dealing with Lepidoptera. In No. 17, Dr. Neave describes a fine collection of butterflies with many new species from the shores of the Victoria Nyanza, made and presented to the Department by C. A. Wiggins, C.M.G., late P.M.O. of Uganda. No. 18, by Dr. Eltringham, containing descriptions of Acraeine butterflies, was one of the papers leading up to the author's great monograph included in an earlier volume of these Reports (IX, No. 3).

No. 19, by the late R. Shelford, contains a description of a remarkable African fly of a new genus and species; while in No. 20 Dr. K. Jordan discusses some of the African Longicorn beetles described by Hope and Westwood.

Nos. 21—23 are papers on the *Blattidae* ('Cockroaches'), completing the great series contained in earlier volumes, by R. Shelford, in his lifetime the leading authority in this group of insects. Although published in 1909—11, it is only possible to issue them now, nearly eleven years after the author's death. A tribute to his memory with a brief account of his life and fine work will be found in Hope Reports, Vol. VIII, No. 2.

The Thysanoptera *(Thrips)* form the subject of Nos. 24—31, all by R. S. Bagnall, except 30 and 31 by C. B. Williams, then working at this group of insects in association with his friend and contributing material to the University collections. Nos. 24 and 25 deal with the family *Aeolothripidae*, Nos. 26 and 30 with Thysanoptera from India and the West Indies respectively, Nos. 27—29 and No. 31 with British species.

In No. 32 R. S. Bagnall describes British insects in the primitive group of the Collembola; in No. 33, the only paper outside the insects, he writes on the classification of the Symphyla *(Scolopendrella*, etc.)

This fine series of memoirs, 24—33, is a pleasant reminder of the time when Mr. Bagnall was officially connected with the Department.

EDWARD B. POULTON.

HOPE DEPARTMENT OF ZOOLOGY,
UNIVERSITY MUSEUM, OXFORD.
October 8, 1924.

CONTENTS OF APPENDIX TO VOL. X.

[*From "The Transactions of the Second Entomological Congress*, 1912."]

PRESIDENT'S INTRODUCTORY ADDRESS.

WITH PLATES I AND II.

It is my pleasure and privilege to bid a hearty welcome to all who are now visiting Oxford for the second International Entomological Congress. Two years ago we met in Brussels for the first, and in every way successful opening meeting of the long series of International Congresses to which we all look forward with confidence. Then the language of our hosts was the beautiful and classic language of France, and at that meeting Frenchmen stood in a special relation to our Belgian hosts. Speaking the same language, they were in a sense, though present as guests, acting as hosts. On this occasion, meeting in Oxford, you are welcomed not only by the entomologists of the British Isles, but also of the British Colonies and of India, and I venture to invite the American members, who speak our language, to act with us as hosts, and to endeavour to make the visit of our continental visitors and colleagues as bright and successful as possible. I know well, from many a happy experience, how gracefully and graciously our American friends play the part of hosts in their own country, and in inviting them to act with us on this occasion

I am sure that I carry with me the feelings and wishes of every British member of the Congress.

I imagine that in the choice of Oxford for the second meeting of the Congress a determining factor was the existence of the Hope Department—the great collection of insects given to the University more than sixty years ago by one of her own sons, and immensely increased by the great name and fame of my distinguished predecessor, Professor J. O. WESTWOOD.

The choice of Oxford gives me the opportunity of expressing gratitude to all those who made the Hope Department—above all to the founders, the Rev. F. W. HOPE and his widow ELLEN HOPE, and to the first Hope Professor, JOHN OBADIAH WESTWOOD. It enables me to acknowledge for him the obligation he had no such great opportunity as this of expressing.

I have brought with me the Visitors' Book of the Hope Department, and in it we see that members of the University first came, on June 12th, 1850, to look at the fine collections, which had just arrived in Oxford. The long list of names shows the immediate interest and attention which were excited in Oxford by the gift of the Rev. F. W. HOPE. The book has received many hundreds of signatures since that date, and preserves a record of the distinguished entomologists who have visited the Hope Collection during sixty-two years; but it is not quite full even now, and I propose to devote the few unoccupied pages to the preservation of the signatures of the members of this Congress. The visitors' book will be placed on a table in the adjoining writing-room, and I hope that every member of the Congress will do me the favour of inscribing his or her name, and thus complete the volume that was begun in 1850.

The Hope Collection was not at first a very large one. In the year 1857 Professor WESTWOOD drew up a detailed inventory in which the contents of 903 cabinet drawers are briefly described: but Mr. Hope was an ideal benefactor, who, for the remainder of his life, never ceased to augment his original gift, buying and adding to it everything of interest to entomological science which he had the chance of acquiring. For about ten years the Hope Collection remained in the Taylorian Building, where it was first accommodated, but it was moved, on the completion of the new University Museum, to a part of the space which it now

occupies. The Hope Professorship of Zoology was established in 1861, and I believe there is little doubt that Mr. HOPE founded it in connection with the migration to the University Museum, a migration contemplated in the original deed drawn up in 1849.

I look back over many years of kindness and most pleasant friendship with my master in Entomology, Professor WESTWOOD —going back to the year 1873, before I became an undergraduate. At that time, as a boy of seventeen, working in the Museum for a scholarship, I often stole an hour from my regular studies in order to visit the Professor and to learn something of the great entomological collection and library. Professor WESTWOOD treated the young beginner with great kindliness and sympathy, and I was permitted to learn much of the intimate thoughts of this eminent leader in the science. Thus, I gathered that of all the long list of classical works which WESTWOOD produced, the one to which he looked back with the deepest interest and affection was his wonderful *Introduction to the Modern Classification of Insects.* I remember his telling me with a touch of pride that the book was known in America as "The Entomologist's Bible."

Another interesting feature which makes it appropriate that the Congress should meet in this Museum is the relation which the building bears to the history of Darwinian teaching. Just fifty-two years ago, on June 30th, 1860, between seven hundred and a thousand people gathered in the room which lies a few yards away to the west of the lecture-theatre in which you are sitting, in order to listen to a discussion on evolution, with DARWIN'S old teacher, Professor HENSLOW of Cambridge, in the chair. That room, where we shall peacefully write our letters and indulge in quiet talk in the intervals of the more strenuous work in the sections, was the scene of the celebrated duel between the Bishop of Oxford and Professor HUXLEY. Hardly any episode in the history of Darwinism has been more discussed, and probably no other produced so much excitement; yet, as oftentimes when feelings run high, it is very difficult to know what actually happened. Many versions have been published,[1] but I believe that the most accurate account is that given by my

[1] See *Life and Letters of Charles Darwin*, Lond., 1887, vol. ii., pp. 320–323; *Life and Letters of Thomas Henry Huxley*, Lond., 1900, vol. i., pp. 179–189.

friend Dr. A. G. VERNON HARCOURT. It will be remembered that the Bishop of Oxford at the climax of his speech turned to HUXLEY and asked him if he was descended from a monkey on his grandfather's or his grandmother's side. Some of those who were present have said that HUXLEY was so angry that he was really ineffective, while others maintain that he was perfectly calm, and rebuked the Bishop with dignity and complete success. His reply, as it is remembered by Mr. HARCOURT, is precisely the sort of answer we should have expected from Professor HUXLEY.

" . . . if I am asked whether I would choose to be descended from the poor animal of low intelligence and stooping gait, who grins and chatters as we pass, or from a man, endowed with great ability and a splendid position, who should use these gifts" [here, as the point became clear, there was a great outburst of applause, which mostly drowned the end of the sentence] "to discredit and crush humble seekers after truth, I hesitate what answer to make." [1]

My eminent predecessor was well over fifty when Natural Selection came before the world in 1858, and *The Origin of Species* in 1859, and it is always exceedingly difficult, generally indeed well-nigh impossible, for a man of that age to mould his ideas afresh. The conspicuous exception was Sir CHARLES LYELL, who, having published his opinions against the new views, finally came late in life to accept them. Such examples must always be very rare, and certainly Professor WESTWOOD was no exception. He remained for the whole of his life strongly opposed to evolutionary teachings; in fact, he proposed to the last Commission that the University should permanently establish a lectureship for the unceasing refutation of the errors of Darwinism. I well remember being asked by Professor WESTWOOD what I had been reading, and how serious he looked when I told him *The Origin of Species*. He seemed to think that it was an unsuitable book for one so young, and that the authorities of the University and my College had been guilty of some indiscretion in allowing it to come into my hands. Nevertheless, WESTWOOD's relations with CHARLES DARWIN were of the most pleasant description, and he was always proud of the fact that one of the Royal Medals was conferred on him, on the nomination of the Council of the Royal

[1] *Life and Letters of Thomas Henry Huxley*, 1900, vol. i., p. 185.

Society, as the result of the representations of Charles Darwin, who had carefully studied the *Introduction to the Modern Classification of Insects.* More than one letter in Darwin's correspondence deals with this very episode.

Oxford is also specially appropriate for the first meeting of the Congress in this country, because it is the seat of the most ancient University in the British Empire, and because much that is interesting and historic may be learnt in the intervals of the varied and voluminous programme which has been arranged. The Colleges have hospitably opened their doors to members of the Congress, and those who are staying at Wadham, founded in 1612, may remember that they are residing in a College of special interest in relation to the history of science in this country; for it was at Wadham that the Royal Society may be said to have begun. A party of friends who met in the rooms of Warden WILKINS—rooms still existing unchanged in the house of the present Warden—afterwards continued their meetings in London, thus creating the "Invisible College," which became the Royal Society. Members of the Congress who have rooms in Merton will be living in the earliest of all Collegiate buildings, and one which, founded in 1264 and established in Oxford ten years later, served as the type followed in both our ancient Universities. Members staying at New College may like to remember that the foundation was established as a kind of "new model" by WILLIAM OF WYKEHAM in 1379.

We have especially to thank the Warden of Wadham for his great generosity in lending his private garden to the members for the whole of the week, so that there, close at hand, we can refresh ourselves in the intervals between the meetings, and can sit and talk in the evenings. We may indeed almost fancy ourselves on the Continent, where beautiful surroundings are more commonly put to such uses than in this country, while some of our friends, though still in Oxford, may now and then imagine that they are at home.

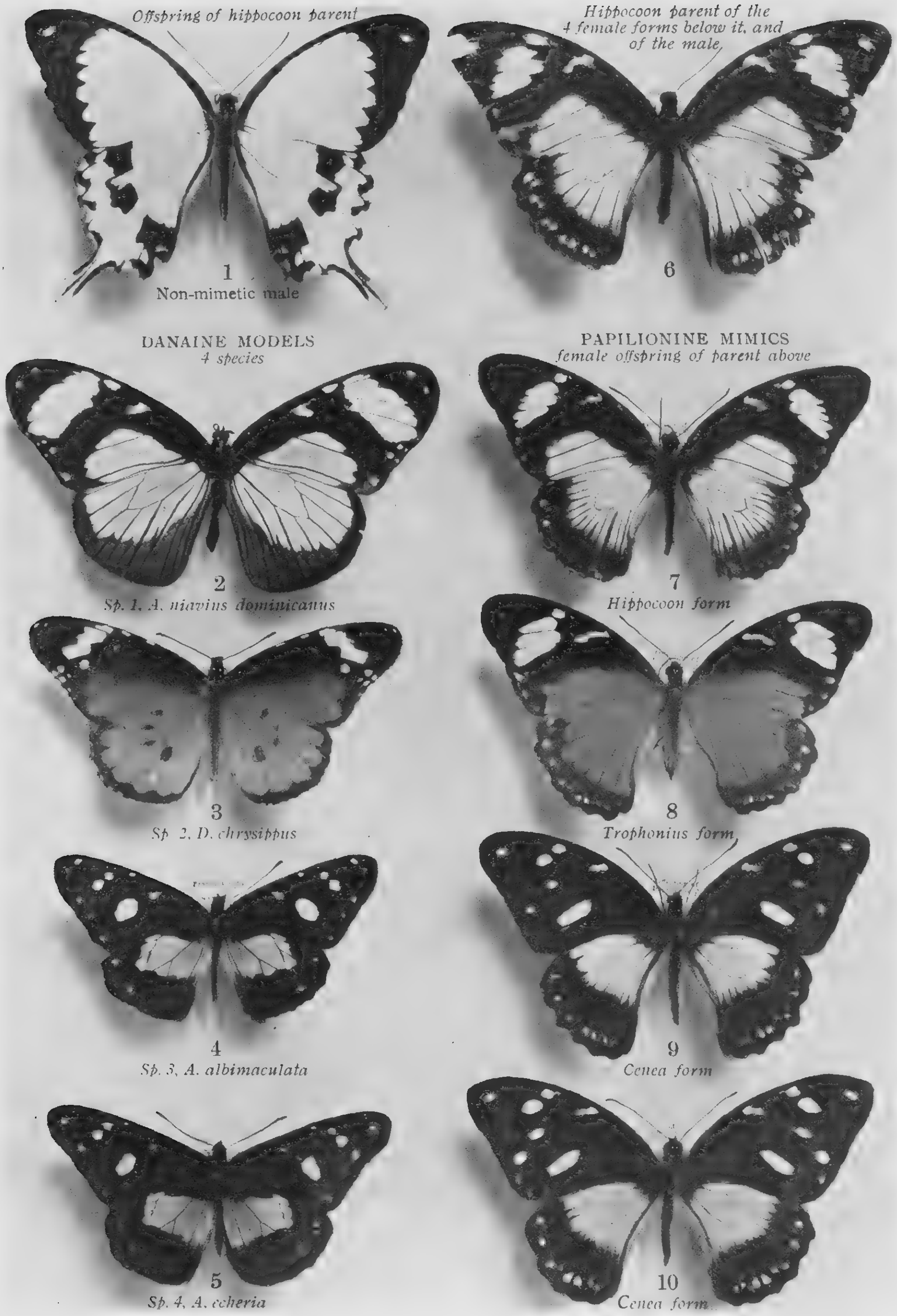
It will be our duty at the conclusion of the Congress to thank the many friends who have helped us to prepare for the meeting, but I must even now, at the very beginning, express our thanks to one or two who have taken a special part in the work of organisation. My friend, Dr. F. A. DIXEY, F.R.S., being Bursar of

Wadham, has settled all the details in the arrangements of which I was just now speaking. The General Secretary, Dr. MALCOLM BURR, who has been himself far from well, is unable to be present in consequence of the very serious illness of his wife. We all extend to him our warmest sympathy, and the hope that Mrs. BURR will rapidly recover, and that he himself will soon be restored to full health and strength. In the meantime Mr. H. ELTRINGHAM, although he has only just brought out a long and exhaustive monograph on the *Acræinæ*, occupying the whole of Part I of the *Transactions of the Entomological Society of London* for this year, has thrown himself into the breach, and, with the assistance of Mr. G. H. GROSVENOR, has enabled us to overcome all the difficulties which threatened to overwhelm our preparations for the meeting.

I must also refer to the friendly and cordial relationship between the University Museum and the two great Museums established near Oxford, the British Museum of Natural History and the great Zoological Museum at Tring. From these two Museums the Hope Department has always received the kindest help, and I am glad to think that we in turn have been able to render them some assistance. We shall have the opportunity on Saturday of visiting the Tring Museum, and I am sure that we all look forward with very great pleasure to that day as a most agreeable and appropriate close to the Congress of 1912.

I propose to devote the remainder of this address to the exhibition and description of the series of the African Swallow-tail butterfly, *Papilio dardanus*, and the related island forms in the University collection. By this single great example I hope to make clear one chief aim of the Hope Department—the study of specific change in relation to geographical distribution and to the organic environment. Members of the Congress who desire to study in detail the work which has been done will have ample opportunity of seeing two great collections—the *Pierinæ* worked out and arranged by Dr. F. A. Dixey, the *Acræinæ* by Mr. H. ELTRINGHAM—as well as the special series, illustrating mimicry and other bionomic principles, in which both the *Pierinæ* and *Acræinæ* play an important part.

The complexity of the problem presented by *Papilio dardanus*



Alfred Robinson, photo.

Andre & Sleigh, Ltd.

Nearly ⅔ of the natural size.

Papilio dardanus cenea, the S. E. African Sub-species of *P. dardanus* with the four Danaine models of its female forms. The proof by breeding that the mimics are one species. (Near Durban, Natal, 1906, G. F. Leigh.)

is sufficiently indicated in the accompanying Plate I, which represents the male (Fig. 1) and four mimetic female forms (Figs. 7 to 10), together with their respective Danaine models (Figs. 2 to 5) from the same geographical area—Natal. Before 1869, when ROLAND TRIMEN'S classical memoir [1] appeared, three of these mimetic females were held to be three different species, and the male a fourth. Figs. 1, 7, 8, 9, and 10 on Plate I are of special interest in that they represent individuals from one of the families bred from a known female parent (Fig. 6), which have put the final coping-stone on the proof brought forward by the great African naturalist and ably defended by him against the fierce attacks of the older systematists.[2]

I think that you will best see what we have been able to do in working out the wonderful history of *Papilio dardanus*, if I arrange in the frame behind the lecture-table the twenty-seven drawers that are now piled before you, giving them such relative positions as will approximately indicate the geographical distribution.

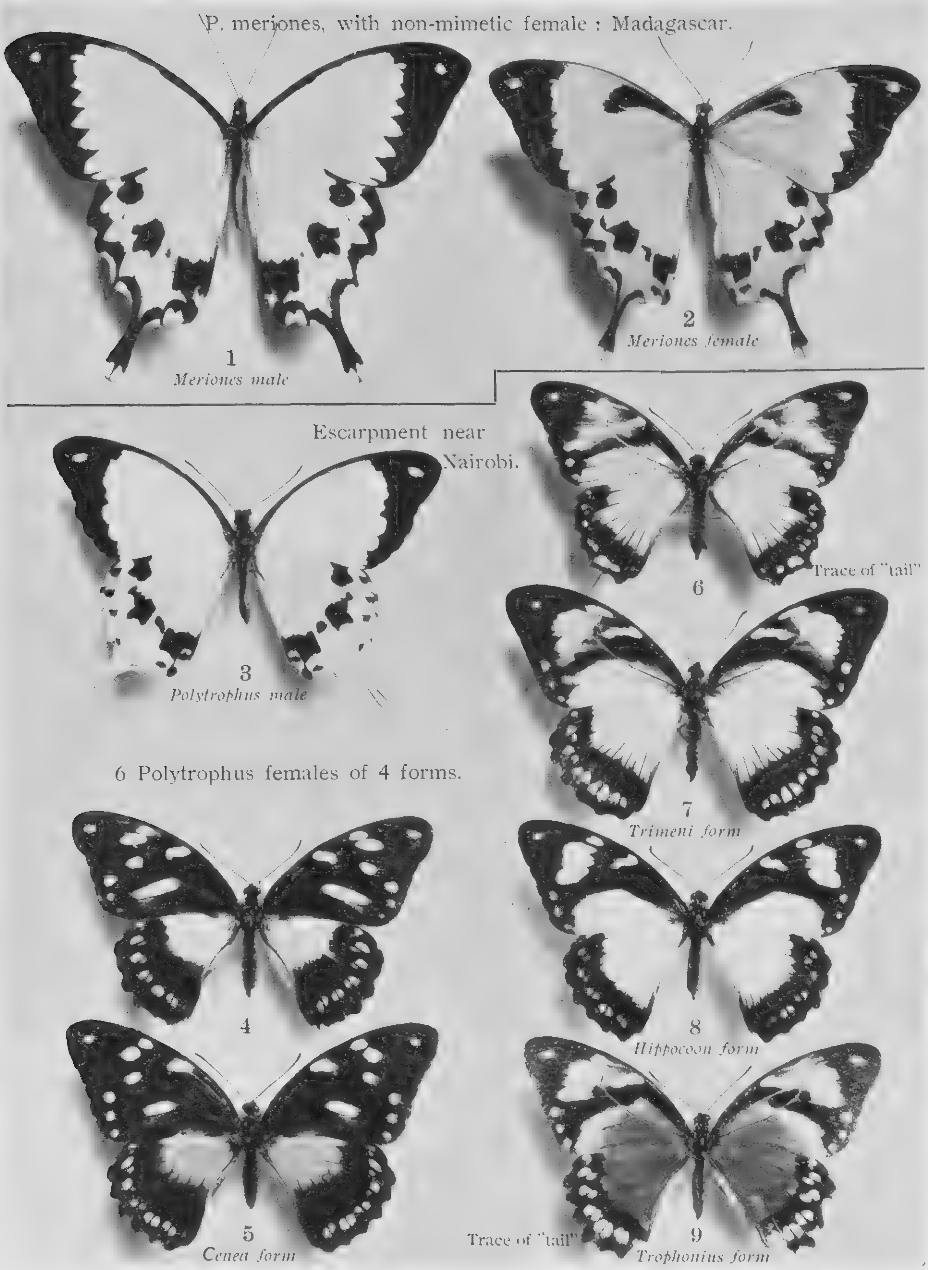
We begin with the ancestral non-mimetic island form confined to Madagascar, *Papilio meriones* (Plate II, Figs. 1, 2). It will be observed that the non-mimetic female differs from the male in the presence of a black mark curving into the forewing cell from the basal half of the costa. This mark is of the greatest importance, for it serves as the starting-point for the mimetic patterns of the continental females (cf. Fig. 2 with 6, 7, and 8 of Plate II). A somewhat similar non-mimetic form, which we do not possess, *P. humbloti*, is found in the Comoro Islands.

We now enter the Ethiopian region—Africa south of the Sahara—at its north-east corner, and here in Abyssinia and Somaliland we find another non-mimetic subspecies, and the only continental one, namely *P. antinorii*, which I next place upon the frame. I have called this subspecies non-mimetic, but as a matter of fact two single mimetic females of different forms have been obtained in Abyssinia. Neither of them has appeared a second time, and they are in themselves so very remarkable, combining the fully formed "tails" of the male butterfly with two highly developed mimetic female patterns,

[1] *Trans. Linn. Soc., Lond.*, vol. xxvi., 1870; Pt. III., 1869, p. 497.
[2] See especially *Trans. Ent. Soc., Lond.*, 1874, pp. 139–141.

that until further evidence is forthcoming one is tempted to regard them as hybrids between a wandering male from further south, carrying tendencies of the mimetic females, and the ordinary female of *antinorii*. Omitting these from consideration until further specimens have been obtained, the *antinorii* male and female are closely similar to the Madagascar *meriones*, except for a considerable reduction of black on both the wings of both sexes. The female still presents the black mark on the costa which is the beginning of the mimetic pattern.

I next place upon the frame the most interesting of all the subspecies, namely *polytrophus*, from the lofty eastern edge of the great Rift Valley, near Nairobi in British East Africa (Plate II, Figs. 3 to 9). Here, on the Kikuyu Escarpment, at an elevation of 6,500 to 9,000 ft., we meet with all the mimetic forms of the female *dardanus*, together with innumerable intermediates and an abundant ancestral form, *trimeni*, which has not entirely lost the yellow ground-colour of the male and non-mimetic female, and shows a prolongation of the costal mark towards the posterior angle of the forewing, giving in different individuals every transition between a marking well-nigh as rudimentary as that of the *meriones* female itself, and the fully formed bar of *hippocoon* (cf. Figs. 2, 6, 7, and 8 on Plate II). It is characteristic of the ancestral *trimeni* females that they are exceedingly variable, and especially so in the degree of development of the bar crossing the forewing. They further commonly exhibit a vestigial trace of the "tail" to the hindwing (Figs. 6 and 9). Comparison between Figs. 6, 7, and 8 shows that the fully formed mimetic female *hippocoon*, resembling in East Africa the Danaine model *Amauris niavius dominicanus* (Plate I, Fig. 2), has been derived from *trimeni* by the transformation of the yellowish ground-colour into white, and the sharpening of the outlines of the most fully developed black pattern. Comparison with Fig. 9 shows that the *trophonius* form, mimetic of *Danaida chrysippus* (Plate I, Fig. 3) over the whole Ethiopian region, is derived directly from *trimeni* by a fulvous flush overspreading the principal pale area extending over a large part of both wings. In the interesting example represented in Fig. 9 the flush does not cover the whole of this area, and the uncovered part, as well as all the other pale markings, are of the yellowish



Alfred Robinson, photo. | Andre & Sleigh, Ltd.

Rather over half the natural size.

The non-mimetic ancestor of *Papilio dardanus (merope)* from Madagascar, and transitional forms, shewing the origin of mimetic females, from the Kikuyu Escarpment, near Nairobi, British East Africa (6,500—9,000 ft.).

tint of *trimeni*. A slight trace of the "tail" is also to be seen in the same specimen. The most specialised of all the mimetic females, *cenea*, mimetic of *Amauris echeria* (Plate I, Fig. 5) and *Am. albimaculata* (Plate I, Fig. 4) in East Africa, and westward as far as the Eastern borders of the Congo State, also appears to have been directly derived from *trimeni*. Thus Fig. 4 on Plate II shows us an example with the fully developed *cenea* pattern, but with all the pale markings retaining the yellowish tint of *trimeni*. Comparison between Figs. 4 and 6 shows that the hindwing of *cenea* is easily derived from *trimeni* by an increase in the breadth of the black border, while the forewing also originated by an increase of black, together with the splitting up of the pale markings into a series of separate spots. The traces of such a process can, in fact, be seen in an initial stage in the outer half of the forewing of the *trimeni* represented in Fig. 6. Comparison between Figs. 4 and 5 shows how the ordinary colours of *cenea* are obtained by a darkening into ochreous of the basal part of the hindwing, while all the other markings become white or sometimes ochreous, according as the form mimics varieties of *Amauris* with white spots or with yellow spots in the forewing. The wonderful mimetic form *planemoides*, resembling the male of *Planema macarista* and both sexes of *Pl. poggei*, is also found among the remarkable assemblage of female forms on the Escarpment, although, if either of its models occurs at all in this locality, it must be extremely rare. The *planemoides* female almost certainly arose in connection with the origin of the *cenea* form: the hindwing, in fact, is almost precisely *cenea's*, except that the basal patch becomes white like *hippocoon* instead of ochreous like *cenea*. In the forewing the pale markings of *trimeni* are not so completely broken up into separate spots as in the origin of *cenea*, but form larger areas which gain a rich fulvous tint and fuse together into a band crossing the wing from the costa to the posterior angle. It is exceedingly interesting to find that an ancestral stage in the development of this pattern is to be found, not only in association with the fully formed *planemoides*, but also in Natal, far south of the range of the *Planema* models. This ancestral stage of *planemoides*—the *leighi* form—indicates very clearly the way in which the forewing band of *planemoides* arose

from *trimeni*. We find, in fact, a forewing pattern which is in part that of *cenea* and in part that of *hippocoon*, but with all the markings transformed into fulvous orange. Intermediate stages between *leighi* and *planemoides* are also found both within the range of *planemoides* itself and also some hundreds of miles eastward of it and its models (see p. 33).

The *polytrophus* females have occupied a good deal of our time and attention, but they are of extraordinary interest as showing us the origin of all the mimetic forms of the species. The pattern of the male *polytrophus* (Plate II, Fig. 3) bears considerable resemblance to the western subspecies *dardanus dardanus*, but there is, I think, little doubt that *polytrophus* is in interbreeding connection not only with *dardanus dardanus* on the west, but with *dardanus tibullus* on the east. In the forest at a lower elevation (about 5,500 ft.), near Nairobi itself, we meet with a larger form of male bearing heavier markings. At this elevation *trimeni* is still to be seen—a fine example, captured by the Rev. K. St. Aubyn Rogers, is in the drawer I have just placed upon the frame, with another remarkable form, apparently a mimic of *Danaida chrysippus* f. *dorippus*, captured in 1903 by the late Mr. C. F. Elliott.[1] There can be no reasonable doubt that these larger specimens of the lower slopes form one interbreeding community with those of the higher, and that *tibullus* on the east is syngamic with *polytrophus* of the lofty Escarpment near Nairobi.

Before leaving *polytrophus* I ought to mention that the remarkable ancestral form *trimeni* appears to belong chiefly to the East African section of the *dardanus* subspecies; for it is not only common at Nairobi, but the first specimen to reach a European collection was captured in 1884 by Lieutenant Turner well within the area of *tibullus* at Zanzibar.[2] Varieties which I think are to be interpreted as forms of the variable *trimeni* have been described by Aurivillius from Kibara, to the west of

[1] *Trans. Ent. Soc., Lond.*, 1908, pp. 554–7. The date of capture is erroneously given as "1893" on p. 556. A coloured figure of the specimen may be seen in Eltringham's *African Mimetic Butterflies*, Oxford, 1910, Pl. X, Fig. 11. Excellent coloured representations of nearly every form of *P. dardanus* are given on the same plate.

[2] *Proc. Ent. Soc., Lond.*, 1897, pp. lxxxviii, lxxxix; *Trans. Ent. Soc.*, 1906, p. 283, Pl. XIX, Fig. 1.

Lake Mweru, and Ukerewe Island in the south of the Victoria Nyanza.[1] On the west coast, *trimeni* appears to be represented by another ancestral form, the relatively rare *dionysus*, which will be considered later.

The next four drawers now placed in the frame represent forms of the subspecies *dardanus dardanus* from Kisumu (Port Florence), the inland terminus of the Uganda Railway on the north-east shore of the Victoria Nyanza, from the northern and north-western shores as far as the Anglo-German boundary. The males of this subspecies, which extends to the west coast, approach, in the relative amount of black marking, those of *polytrophus* on the high Escarpment and the Madagascar *meriones*. The females resemble Danaine and Acræine models of their locality, and here too, in the eastern part of the range of the western subspecies, all the mimetic female forms are represented. The commonest is *hippocoon*, and next *planemoides*, while *trophonius* and *cenea* are both relatively rare.[2] The white sub-apical bar of *trophonius* is often transformed into fulvous (the *niobe* form) in mimicry of *Planema tellus*, and in a

[1] *Arkiv f. Zool., K. Svenska Vetenskapsakad.*, Stockholm, Bd. 3, No. 23, 1907.

[2] The corresponding female forms of the various subspecies of *P. dardanus* were called by the same names in the address, notwithstanding the fact that there are slight differences between them. Such differences seem to be sufficiently indicated by prefixing the subspecific name. I wrote upon this point in 1906: "The name *hippocoonoides* has been given by HAASE to this form [*hippocoon*] in the eastern and southern subspecies *tibullus* and *cenea*. This seems to me a most unnecessarily complex and inconvenient procedure. The *trophonius* of the western subspecies [named *trophonissa* (1907) by AURIVILLIUS] *merope* [*dardanus*] is at least as different from that of the southern *cenea* as are the two forms of *hippocoon* from the same areas. It is pretty certain indeed that each female form of every subspecies has certain peculiarities and is not exactly like the same form of any other subspecies. But this is quite sufficiently indicated by prefixing to the female form name the subspecific name. *Papilio dardanus* subspecies *merope* ♀ f. *hippocoon* of the west coast is naturally different from *P. dardanus* subspecies *cenea* ♀ f. *hippocoon* from Natal, and it is quite unnecessary to express this by turning the last name into *hippocoonoides*. To do so without making corresponding changes in the other forms is inconsistent; to be consistent in this respect is immensely to increase and to increase uselessly an already tremendous terminology." *Trans. Ent. Soc., Lond.*, 1906, p. 289.

fine variety from Entebbe presented by Mr. H. ELTRINGHAM it will be seen that the bar is fused with the principal fulvous marking. *Papilio dardanus* has not as yet been bred either at Nairobi or in Uganda,[1] and this final proof that *planemoides* belongs to the *dardanus* association is still wanting. Nevertheless, a single specimen now before you constitutes in itself conclusive evidence that *planemoides* has been rightly placed. This specimen was collected by Captain T. T. BEHRENS in Buddu (1902–3), and it is gynandromorphic on the left side, the yellow scales and part of the dark markings of the male *dardanus* being dovetailed into the pattern of the female *planemoides*.[2] It is quite certain that such an intermixture of characteristics can only occur between the male and female of the same species, and that therefore *planemoides* is one of the female forms of *dardanus*.

It is interesting to consider the probable causes of the relative rarity of the mimetic female forms in Uganda; *hippocoon* mimics *Amauris niavius*, the most conspicuous Danaine, and probably the most conspicuous butterfly of the African forests; *planemoides* mimics the highly conspicuous pattern of the male *Planema macarista* and both male and female *Pl. poggei*; *trophonius* mimics the ubiquitous *Danaida chrysippus*, but this is an open country and woodland butterfly, not a forest species like its mimic, and the two would only be commonly associated along the borders of their respective stations. This relationship almost certainly accounts for the fact that, although *trophonius* occurs in all the subspecies of *dardanus* with mimetic females, it is nevertheless invariably a rare form. *Cenea* mimics *Amauris echeria*, which is excessively abundant in Uganda, the rarer

[1] Since this address was delivered, Dr. G. D. H. CARPENTER has succeeded in obtaining 26 eggs from a *planemoides* female on Bugalla, one of the Sesse Islands, in the north-west of the Victoria Nyanza. He kindly wrote to me early in the course of the breeding experiment, and, as I happened to be publishing an article on *P. dardanus* at that time (*Bedrock*, April 1913, p. 42), I alluded to his investigations in the following words: "We may anticipate that the offspring will be chiefly or entirely *planemoides* and *hippocoon*." On the very day when I was correcting the proofs (March 7th, 1913), I received another letter telling me the results, namely 3 *planemoides*, 7 *hippocoon* and 12 males (l.c., p. 47 *n.*). The whole family is now in the Hope Department. See *Proc. Ent. Soc., Lond.*, 1913, pp. xxxiii–xxxv, also for June 4th.

[2] *Trans. Ent. Soc., Lond.*, 1906, p. 297, Pl. XVIII, Fig. 4.

Am. albimaculata, and the relatively very rare *Am. grogani*. These butterflies, however, although as a whole a very important element in the Danaine fauna, have not the conspicuous pattern of *Am. niavius*, and it is to be observed here, as in other parts of Africa, that when these two Danaine patterns exist side by side the more conspicuous one exerts a far more powerful influence upon the mimetic forms of *dardanus*, even when the model which bears it is not nearly so abundant as the others (cf. p. 34).

We pass to the tropical west coast represented in the seven drawers now placed in the frame. The northern section is marked by the excessive predominance of *hippocoon*, corresponding with the fact that, of the series of models mentioned in the preceding paragraph, only *niavius* and *chrysippus* exist in this part of the range. Furthermore, *chrysippus* is represented by the tropical west coast form *alcippus*, with white hindwings, and is therefore even less suitable than in other parts of Africa as a model for *dardanus*. Along the whole of the tropical west coast the strange ancestral form *dionysus* occurs in relatively small numbers. This female possesses a primitive forewing pattern much like that of *trimeni*, but it has entirely lost the yellow ground-colour of the male, being white-marked like *hippocoon*. The hindwing is yellow, resembling, but paler than, that of the western *trophonius*. The forewing pattern exhibits, like *trimeni*, great variation in the development of the black bar which originates the mimetic pattern. In some individuals it is even more rudimentary, and therefore more like the Madagascar female, than in any *trimeni* that I have seen.

We may feel confident that the results of breeding from a female form in any locality may be fairly accurately predicted by looking to the relative proportions of female forms which there exist. For this reason I anticipated that the great majority of families bred in the northern section of the west coast would yield *hippocoon* and nothing else. Owing to the kindness of Mr. W. A. LAMBORN I have fortunately been able to test this conclusion, and the drawers before you contain three families bred by him from *hippocoon* females, in the Lagos district. These families contain respectively 14, 13, and 10 females, and all are of the *hippocoon* form.[1]

[1] *Proc. Ent. Soc., Lond.*, 1912, pp. xii–xvii. Since the address was

It is of importance to note that the pattern varies somewhat in the different families, the first showing an evident tendency towards the enlargement of the principal white patch which spreads over part of both wings. The *hippocoon* form of the east coast differs from that of the west in the increased size of this patch, corresponding with the difference between the eastern *Amauris niavius dominicanus* and the western *Amauris niavius niavius*. It is therefore of much interest to find on the west coast a hereditary tendency towards slight changes in the size of the patch. It is reasonable to suppose that by selection operating upon such small hereditary differences the eastern *hippocoon* could be derived from the western, and *vice versa*.

In the southern section of the tropical west coast the female forms become more varied, and we again meet with *planemoides*, doubtless continuous, across the great tropical forest, with the assemblage of the same forms in Uganda, and corresponding with the co-existence of the appropriate *Planema* models over the whole area. The single specimen before you from Angola is of interest as being probably the first example in any European collection. It was collected in 1873 by W. ROGERS.[1] The relatively frequent occurrence of *niobe* also probably corresponds with the presence of its *Planema* model.

We now return to Nairobi, the central point of the great

delivered Mr. LAMBORN has bred three more families, containing respectively 14, 7, and 6 females, all *hippocoon*. He also obtained a few eggs from a *dionysus* form, but unfortunately these failed to hatch. I suggested to Mr. LAMBORN that it would be of great interest to ascertain the effect of artificial cold during the pupal stage of the female forms. In his locality, Oni, seventy miles east of Lagos, it was impossible to keep up a continual supply of ice, but the first of the families mentioned in this footnote was exposed for a few days to a temperature (about 50° F.) which for that part of the world would be unusually low, and it was interesting to observe that 4 out of 14 of the females possessed slight but distinct traces of the "tail" of the male hindwing. Of the other five families only one included females with traces of the "tail"—two similar to the ♀♀ mentioned above and two others with slighter indications. Hence it is not unlikely that an effect was produced by the artificial cold. It is to be hoped that this experiment may be repeated in a locality more favourably placed for the maintenance of a low temperature. See *Proc. Ent. Soc.*, 1912, pp. cxxxi–cxxxiv.

[1] *Proc. Ent. Soc., Lond.*, 1903, pp. xxxix–xli.

series of *dardanus* forms, and place in the frame the drawers representing the subspecies *tibullus*, which extends from the Escarpment to the east coast and spreads southwards till it insensibly passes into the south-eastern and southern subspecies *cenea*. The male *tibullus* is characterised by heavy black markings, especially on the hindwing. It may be interesting to those who look on climatic conditions as the causes of variation to note that the *hippocoon* form of the east coast, with its drier climate, shows a reduction in the black markings as compared with the same mimetic form on the moister west coast, but that the males, on the contrary, are far more heavily marked with black on the east coast than on the west! If therefore climatic conditions are of any avail in the production of these patterns, it is obvious they have wrought opposite effects on the two sexes of *dardanus*.

It is interesting to pause for a moment and compare the development of the black markings of the male subspecies of *dardanus*. These markings are least developed in the north-eastern *antinorii*, moderately developed and to much the same extent in the Madagascar *meriones*, the Nairobi *polytrophus* and the western *dardanus*, by far the heaviest in the Eastern *tibullus*. As we pass southward into *cenea* the markings again become less heavy, in some individuals indeed approaching those of the west-coast males. Nevertheless, as a whole, *cenea* is more heavily marked with black than any other subspecies except *tibullus*.

The first two drawers exhibit *tibullus* from Nairobi to the British East African coast, and southward into German East Africa. *Hippocoon* is still seen to be by far the commonest form. The single *trimeni* from Zanzibar, already referred to (see p. 28), is to be found in one of the drawers. *Trophonius* and *cenea* are both present, in correspondence with their models, while the second drawer contains the single remarkable *planemoides* from the Mombasa district (see p. 28).

The next two drawers now placed in the frame represent an exceedingly fine collection from a little patch of primitive forest on Mount Chirinda (3,800 ft.) in S.E. Rhodesia, close to the Portuguese border, a tract of country formerly known as Gazaland. From this locality, owing to the kindness of my friends

Mr. GUY A. K. MARSHALL and Mr. C. F. M. SWYNNERTON, I am able to show the great series now before you. The whole of the females are seen to be *hippocoon*, but *cenea* and *trophonius* also occur, although they are relatively rare. The Oxford University Collection possesses two of each, but these are kept in the special mimicry series, together with their models from the same patch of forest. It is interesting to notice that the Chirinda Danaine models of *cenea*, namely *Amauris albimaculata* and *Am. lobengula*, are together far commoner than *Am. niavius dominicanus*, the model of *hippocoon*, but that nevertheless the latter Danaine, with its far more conspicuous appearance, has produced a much stronger effect on the mimetic female forms of *dardanus* (see p. 31). Turning to the males, it will be seen that the series from Chirinda is intermediate between the more heavily marked *tibullus* of the north and the less heavily marked *cenea* of the south. There is great individual variation, and some of the males would be placed in one category, some in the other.

We now come to the subspecies *cenea*, from Cape Colony and Natal. The specimens in the first drawer are of historic interest in that they provided the first evidence obtained by breeding, but not from a known female parent, that the Protean forms of *dardanus* belong to a single species. The drawer contains two *trophonius* and two *cenea* females bred in 1873–4, near King William's Town, in the south-east of Cape Colony, by the late J. P. MANSEL WEALE [1]; also one *trophonius*, one *hippocoon*, two *cenea*, and one intermediate form collected by the same naturalist in 1870–4. These specimens, purchased for the University Collection in 1878, undoubtedly convinced Professor WESTWOOD that ROLAND TRIMEN'S conclusions were perfectly sound. I well remember being shown these very specimens by WESTWOOD, and the enthusiasm with which he explained that in the Madagascar representative of *P. merope*, as *dardanus* was then called, the female resembled the male, while the continental females appeared with all kinds of patterns widely different from each other and even more widely different from their own male. I am glad to make this fact known, and to be able to show that, a few years after the following passage was published by ROLAND TRIMEN, my

[1] *Trans. Ent. Soc., Lond.*, 1877, p. 269.

great predecessor had not only ceased to be an opponent, but was teaching the very conclusions he had at first disbelieved.

"Among the lepidopterists with whom I have the pleasure to be acquainted, I think the most uncompromising opponent of my view of this matter was my friend Mr. HEWITSON;—though I must say that our distinguished President, Professor WESTWOOD, was almost as resolute in his unbelief. I am not aware that the latter published anything on the subject. . . ." [1]

The following drawer contains specimens of *cenea* from Natal, where the same female forms as those of Cape Colony are found, together with the peculiar ancestral form *leighi*.

The last series of drawers I have the pleasure of showing you contains the fine synepigonic groups which I owe to the energy and ability of G. F. LEIGH, F.E.S., of Durban. All these have been bred by Mr. LEIGH from females captured at Durban, or in the Durban district.

The first two families were bred from *hippocoon* females, and they show an extraordinary contrast. The first,[2] bred in 1906, contains 14 males, and the following females—3 *hippocoon*, 3 *trophonius*, 3 *cenea* with white, 5 with more or less yellow marks on the forewing. The parent of this family, together with one of its male offspring, and each of the four female forms with its Danaine model, is represented in the accompanying Plate I. The second family,[3] bred in 1907, contains 16 males, while of the 13 females all are *cenea*, and not a single one like the parent.

We now pass to families bred from *trophonius* parents, of which there are 3. The first,[4] bred in 1903, contains only 3 males, and 2 *cenea* females. The second,[5] bred in 1904, from a *trophonius* parent which unfortunately escaped, contains 6 males, 1 *trophonius*, and 5 *cenea*. It is interesting to note that the rich fulvous colouring of the *trophonius* parent has produced a distinct effect upon the hindwing patch of one of the *cenea* offspring. The third family,[6] bred in 1910, is both large and remarkable,

[1] TRIMEN in *Trans. Ent. Soc., Lond.*, 1874, p. 139.
[2] *Trans. Ent. Soc., Lond.*, 1908, p. 434, Pl. XXIII.
[3] *Ibid.*, p. 442.
[4] *Ibid.*, 1904, p. 685, Pl. XXXI, Figs. 9–14.
[5] *Ibid.*, 1906, p. 281, Pl. XVII.
[6] *Proc. Ent. Soc., Lond.*, 1911, p. xxxiii.

containing 25 males, 2 *hippocoon*, 4 *trophonius*, 2 *leighi*, and 22 *cenea*, of which 5 show strongly the effect of the parental colouring. The collection also contains the *trophonius* parent,[1] but not the offspring, of another family bred in 1912 by G. F. LEIGH. The family contained 11 males, 2 *hippocoon*, 4 *trophonius*, 1 *leighi*, and 9 *cenea*.

The last two synepigonic groups were the offspring of *cenea* females. The first[2] was bred in 1902 from a *cenea* female captured *in copulâ*, so that of this family—7 males, 2 *hippocoon*, and 6 *cenea*—both parents are present. The second family,[3] bred in 1907, contains 15 males, 1 *hippocoon*, and 16 *cenea*. In this last family the forewing spots of the *cenea* offspring are somewhat unusually developed—a feature evidently inherited from the female parent. It is also noteworthy that the depth of the black markings of the male varies greatly in the different families described above, and it seems quite clear that the extent to which this characteristic is developed is also hereditary.[4]

I trust that the series of specimens now before you conveys some idea of the spirit in which we try to carry on our work.

I conclude, as I began, by bidding you a hearty welcome, and by expressing the hope that you will always look back with pleasure upon the week you are about to spend in Oxford.

[1] *Proc. Ent. Soc., Lond.*, 1912, p. cxxxv.

[2] *Trans. Ent. Soc., Lond.*, 1904, p. 679, Pl. XXXI, Figs. 1–8.

[3] *Trans. Ent. Soc., Lond.*, 1908, pp. 337–441, 443–445, Pl. XXIV.

[4] *Ibid.*, pp. 429 and 443.

[*From "The Transactions of the Second Entomological Congress,* 1912."]

The President then gave his farewell address, as follows:

Ladies and Gentlemen: Our principal and most pleasant duty, on this last formal meeting of the second International Entomological Congress, is to thank those who have so kindly helped us to make the meeting a success.

We have to thank the Delegates of the Oxford University Museum for the use of this lecture-room and the central court of the Museum; among the Heads of the Museum Departments—Prof. BOWMAN for the use of the writing-room, Prof. BOURNE for rooms in his Department, Prof. SOLLAS for his lecture-room, and Prof. Sir W. OSLER for the Secretary's room.

We also desire to thank the two assistants in the Hope Department, Mr. A. H. Hamm and Mr. J. Collins, for helping the members of the Congress to study the collections, and to express our gratitude to many workers in the Department who have also given the kindest assistance—Mr. R. S. Bagnall, Dr. Dixey, Mr. Eltringham, Dr. Longstaff, the Rev. K. St. Aubyn Rogers, and Commander Walker.

That the Congress has passed so successful a week, in spite of the unfortunate weather, is mainly due to two circumstances. The first we owe to the Delegates of the University Museum, namely the fact that all our formal meetings, and the Hope Collections, which have provided interest between the meetings, have been under a single roof. The second fortunate circumstance we owe to the generosity of the Warden of Wadham College—the proximity of the tent in which we have been able to take our meals, and the beautiful garden where we have walked and rested, when the weather permitted, in the intervals between our meetings.

We desire cordially to thank the Warden and Fellows of New College for the use of the College Hall for the opening meeting, the Warden and Fellows of Wadham College for lending the Hall for our banquet, the Warden and Fellows of Merton College, New College, and Wadham College for allowing members to reside in College rooms, and for all the exceedingly efficient arrangements which have been made. With these thanks we desire especially to associate the names of Mr. E. S. Goodrich, F.R.S., Mr. Geoffrey Smith, and Dr. F. A. Dixey, F.R.S., for acting as hosts in their respective Colleges. I must especially speak of the kindness of Dr. Dixey in undertaking, at very short notice, to arrange for the banquet at Wadham, and also for all the details, which have been so necessary for our comfort, that have been planned by him in the Warden's garden and in the College.

In speaking of the Colleges we also wish to thank the Principal and Fellows of Jesus College, the Provost and Fellows of Queen's College, and the Rector and Fellows of Lincoln College, who had kindly given the necessary permission for rooms to be occupied if the number of the members had made it necessary ; and here I may say that I am sure that had it been needful other Colleges would have been equally ready with their kind permission.

The success of the meeting has also been greatly assisted by those Oxford residents who have offered hospitality to our visitors, and we desire to give our special thanks to Prof. and Mrs. BOURNE, Prof. and Mrs. PERCY GARDINER, Dr. and Mrs. HOEY, Mr. and Miss NAGEL, and Mr. and Mrs. ARTHUR SIDGWICK. I wish also to thank Mrs. DIXEY and my wife and my daughter for all they have done in helping to entertain members of the Congress.

The two excursions on Wednesday formed an important feature of the meeting, and our thanks are specially due to those who have so kindly received us, as well as to others who have expressed the wish to offer hospitality to the Congress, and would have done so had our numbers been larger. We heartily thank the President and Fellows of St. John's College for entertaining the party in Bagley Wood, and also the Rt. Hon. L. V. HARCOURT, M.P., for his spontaneous suggestion that a party should visit Nuneham. We also warmly thank Sir ARTHUR EVANS, F.R.S., who invited us to Youlbury, and Mr. VERNON and Lady MARGARET WATNEY, who invited us to Cornbury Park, and we express our regret that the numbers of the Congress were not sufficient for us to accept this kind hospitality, as we should have greatly wished to do. I also desire to thank in advance the Hon. WALTER ROTHSCHILD, F.R.S., for the excursion to the Tring Zoological Museum which will take place to-morrow—a fitting and delightful end, to which we are all looking forward with so much pleasure and interest.

For the preliminary preparations, which had to be made long before the opening of the Congress, we have to thank the very efficient local committee with Dr. DIXEY as chairman. At a time when he was especially busy in preparations for the visit to Oxford of Delegates for the 250th Anniversary of the Royal Society, at such a time of stress, and with his many other insistent duties, Dr. DIXEY arranged for all the meetings of this committee, and hospitably entertained its members in Wadham College. We have to thank the secretaries, Mr. H. ELTRINGHAM and Mr. G. H. GROSVENOR and the other members, all of whom rendered most efficient help. Among them I may especially mention Dr. G. B. LONGSTAFF and Prof. SELWYN IMAGE, who came to Oxford on purpose for the meetings, and Commander

WALKER, who edited the guide-book. I may here also express our indebtedness to Prof. SELWYN IMAGE for his very kind help in designing the badge.

We also received the kindest assistance from Mr. WALTER ROTHSCHILD and Dr. KARL JORDAN, who visited Oxford on purpose to give help and advice.

I spoke, at our opening meeting, of the sad cause of Dr. MALCOLM BURR'S absence, and we all rejoice with him that Mrs. BURR'S health is now so far restored that he has been able to spend the last days of the Congress with us in Oxford. His enforced absence led to much difficulty, and might have led to disaster. On Thursday of last week at this time the manuscript copy of our Programme had not been written, and I really do not know the hour of night or early morning at which Mr. ELTRINGHAM took it to the printers. When we remember that Saturday is only a half-day, it will be realised what this meant; but owing to the way in which Mr. ELTRINGHAM threw himself into the breach, and also to the very efficient help that Mr. GROSVENOR was able to afford him during part of the time, all our difficulties have been overcome. I must here also speak of the great kindness of Mr. H. ROWLAND-BROWN, who, when he heard of our difficulties last week, telegraphed to us, offering to come to Oxford and help.

At this, the last of our most successful meetings, I am sure you would wish to thank all Presidents, Vice-Presidents, and Secretaries of Sections, all readers of papers, and those who have contributed to the discussions. And, for myself, allow me warmly to thank every one of you for the great kindness and consideration shown to me throughout the meeting.

We now adjourn—all of us, I am sure, looking forward to our next meeting in Vienna, under the presidency of my distinguished successor CUSTOS A. HANDLIRSCH.

[*From "The Transactions of the Second Entomological Congress,* 1912."]

THE BANQUET.

HELD IN THE HALL OF WADHAM COLLEGE, FRIDAY, AUGUST 9TH.

Early in the week it was found impracticable to hold the banquet in the Hall of Christ Church, as had been intended, but thanks to the efforts of Dr. F. A. DIXEY it was arranged, by kind permission of the Warden and Fellows of Wadham, to hold the dinner at that College.

A very large number of the members of the Congress sat down to an excellent repast served in the fine old Hall.

Following the usual loyal toast, the President said he now had the honour of proposing the toast of the science that they were celebrating at the Oxford Congress, and that they would continue to celebrate in future Congresses—"Success to Entomology." A friend who was in a high position in the British Colonial Office once told him that, whenever he heard of an appointment to be made in the Colonial service, where a young man was wanted for a position of responsibility in a trying climate, he always inquired whether there was a naturalist available for the post. He knew well that in an enthusiastic naturalist he would also secure a better public servant (applause). The contemplation of such beneficial results arising spontaneously from the gratification of certain intellectual interests, led us to inquire why it was that we studied natural history, entomology, or any other science. If they analysed the reasons, he thought they would agree with him that the primary, in fact the only real motive, was that of finding out; they worked because they were interested, and any further object, however laudable in itself, only tended to bias and mar the inquiry. He remembered hearing Sir MICHAEL FOSTER say that it was by curiosity that our first parents lost the Garden of Eden, but that by transmitting to us that same curiosity, they had given us a golden bridge, by which we were able to re-enter Paradise (laughter). There was a correspondence on this very subject between DARWIN and his old Cambridge teacher HENSLOW,

who had maintained that science pursued without a practical end was merely building castles in the air.

DARWIN'S reply seemed to him unanswerable:

"I rather demur to one sentence of yours," he said—"viz. 'However delightful any scientific pursuit may be, yet, if it should be wholly unapplied, it is of no more use than building castles in the air.' Would not your hearers infer from this that the practical use of each scientific discovery ought to be immediate and obvious to make it worthy of admiration? What a beautiful instance chloroform is of a discovery made from purely scientific researches, afterwards coming almost by chance into practical use! For myself I would, however, take higher ground, for I believe there exists, and I feel within me, an instinct for truth, or knowledge or discovery, of something of the same nature as the instinct of virtue, and that our having such an instinct is reason enough for scientific researches without any practical results ever ensuing from them." [1]

DARWIN here gave the real motive for research, and they would notice that when the followers of the more fundamental sciences, Physics and Chemistry, began to think of practical commercial uses, the science of their investigations dropped to another and a lower level. He expected that they had heard of the terms which had been suggested for the different degrees in the attainment of inaccuracy—how there were liars, liars with an uncomplimentary adjective, and "expert witnesses" (laughter). If that were true—even in the least degree true—it meant of course that the scientific spirit was incompatible with the qualities required in an expert witness. He dwelt on these facts because he thought that Entomology stood out as the one science in which a practical application was, in his experience, without an injurious effect upon investigation. In Entomology, scientific inquiries of all kinds were going on for the purpose of helping mankind, but in spite of the application their researches could still be conducted on purely scientific lines; and he did not know of any other science for which this could be said so truly as it could for Entomology. If this opinion were sound, it followed that our science occupied a high position in the scale of human

[1] *More Letters of Charles Darwin*, London, 1903, vol. i., p. 61. Letter dated April 1st, 1848.

knowledge. Economic Entomology was a vast field in which practical applications were sought, and sought most successfully, and yet if any one wished for examples of work carried out in the true spirit of science, he could not do better than visit Dr. L. O. HOWARD at Washington, Prof. W. M. WHEELER at Harvard, Dr. R. C. L. PERKINS in Honolulu, or the rooms in our National Museum from which Mr. GUY A. K. MARSHALL inspires and directs the investigations of many a naturalist in Africa.

For this special reason, as well as for its many other unrivalled charms, he invited them to drink the toast of "Success to the Science of Entomology."

He would close in the words of CHARLES DARWIN, who, in a letter to Sir JOHN LUBBOCK, wrote:

"I feel like an old war-horse at the sound of the trumpet, when I read about the capturing of rare beetles—is not this a magnanimous simile for a decayed entomologist?—It really almost makes me long to begin collecting again. Adios.

"'Floreat Entomologia!'—to which toast at Cambridge I have drunk many a glass of wine. So again, 'Floreat Entomologia.' N.B.—I have *not* now been drinking any glasses full of wine." [1]

[1] *Life and Letters of Charles Darwin*, 1887, vol. ii., p. 141. Letter written before 1857.

Extrait du *Ier CONGRÈS INTERNATIONAL D'ENTOMOLOGIE*, 1910.

Mimicry,

by Dr. F. A. Dixey, F. R. S. (Oxford).

At the outset of my discourse I should wish to say that I feel highly honoured by the invitation to address so notable a body of scientific men as are gathered together in the First International Congress of Entomology under the guidance of our distinguished President; and to express the hope that this may be the beginning of a long series of Congresses, which in advancing the study of Entomology will confer benefits upon the race, and contribute towards the great object of international amity.

The subject to which I propose to devote this lecture is that of Mimicry; a subject which has formed perhaps the largest part of my studies in Insect Bionomics.

It may, I think, be assumed that all naturalists are acquainted with the main features of what is known as « *Mimicry* ». But it may be doubted whether all naturalists realise how numerous are the facts which can be ranged under this head, or how complicated are the phenomena with which a full consideration of the subject brings us into contact.

We should, I venture to think, be false to all the best traditions of scientific method, if, with this great array of remarkable facts before us, we made no attempt to interpret them. It is hardly necessary for me to point out that while in the region of fact we may reasonably hope to attain a great measure of certainty, our interpretations must be to a large extent provisional. It is true that the day may come when we shall be able to speak positively, and with general agreement, as to the causes and full bionomic significance of these noteworthy resemblances; but the time is not yet,

and we must be content, for the present, to examine and to test, by every means in our power, those explanations that have from time to time been offered. The fuller our knowledge of the facts to be accounted for, the more nearly true is our interpretation likely to be; and this is the justification for reviewing in some detail any kind of evidence that may have a bearing on the question before us. And I will ask my audience to be good enough to observe that, when I use the term « mimicry », I do so at present, as the lawyers say, « without prejudice ».

Many cases of mimicry between Insects of different orders have long been known. The very remarkable resemblance borne by certain Moths to some of the stinging Hymenoptera long ago attracted the attention of observant naturalists. BOISDUVAL drew attention to the fact that three Butterflies belonging to three different families, namely *Limnas chrysippus*, the female of *Hypolimnas misippus*, and the *trophonius*-form of the female of *Papilio dardanus*, show a close resemblance to each other in outward aspect. Of late years very numerous instances of a similar kind have come to light. Sometimes the observed resemblance occurs between Insects of the same order but of different families, as between the Papilios and Pierines among the Butterflies; e. g., *Papilio nephalion* and *Euterpe rosacea*; sometimes between Insects of different orders. We find, for example, Ants mimicked by *Hemiptera*, *Homoptera* and *Orthoptera*, while other *Hymenoptera* are closely copied by two-winged Flies. It is needless to multiply instances of this sort, for numbers of them must be familiar to all working naturalists. And when the extraordinary prevalence of this phenomenon is once realised, it becomes impossible to dismiss the question as being merely a matter of coincidence. If we had only a few such instances to consider, we might be justified in calling them accidental. But, apart from other reasons, their very number raises the improbability of such an interpretation to so high a pitch as practically to forbid its acceptance.

Let us look at the facts a little more closely. We have seen that some of the nearest resemblances occur between Insects of different orders. We may therefore dismiss at once the idea that the likeness is merely due to affinity. At the same time there is no doubt that the element of affinity does to some extent enter into the question. We shall return to this point later.

A short examination of cases will show us that the mimicry is often confined to the female sex. It is well known that in the instances mentioned just now it is only the *female* of *Hypolimnas*

misippus that resembles *Limnas chrysippus;* and the same statement applies to *Papilio dardanus*. This latter Butterfly, as is also well known, supplies us with another feature in the case. The female is polymorphic, and each form of the female is a copy of a different Danaine model. I show here a representation of a brood of this *Papilio*, all the specimens being the offspring of a single female. The *trophonius*-form, as we have seen, mimics *Limnas chrysippus*, the *hippocoon*-form resembles *Amauris dominicanus*, and the *cenea*-form is in mimetic relation with *Amauris echeria* and *Amauris albimaculata*. This curious phenomena is by no means an isolated case, as is shown by the next illustration. We have here the male of the African Pierine *Leuceronia argia*, in which sex the species is practically invariable. But the female exists in many different forms, each of which shows a resemblance to a Butterfly of no very close affinity to *Leuceronia*. The mimicked Insects belong to the genera *Belenois*, *Mylothris*, *Phrissura* and *Pinacopteryx*.

There are cases on record in which both male and female of a sexually dimorphic Butterfly are mimetic, but the respective models of the two sexes are different. I do not at the present moment recall any instance of a species where the male is a mimic and the female not.

We have then reached this point : that the female sex is more susceptible to the mimetic influence, whatever it may be, than the male. This is shown by the numerous cases of sexual dimorphism in which the female alone mimics, and also by those examples of polymorphism, confined to the female, in which each separate form assimilates itself to a different model.

We may now pass on to another consideration. In all the instances that I have shown, the forms that so resemble one another are found in the same, or nearly the same, regions and localities. In many cases they are observed to have similar habits. It has often happened that a group of Insects, diverse in affinity but closely allied in aspect, has been taken, not only on the same day and within a limited area, but actually on the same plant. The illustration I now exhibit depicts a wonderful assemblage of Insects, all characterised by the same arrangement of colours, comprising Wasps, Braconids, Moths, a Bug, a two-winged Fly, and Beetles of different families; many members of which assemblage I have myself seen settled on or flying about the same tree at East London in South Africa. And what is perhaps even more remarkable, we find that when geographical races, or represen-

tative species, inhabit different areas of the same continent, the members of these mimetic groups all change their aspect together, and in the same direction. By the kindness of Professor POULTON, I am enabled to illustrate this statement by a very beautiful series of Butterflies from Central and South America. The assemblage in question contains species of very diverse affinities, including Ithomiines, Heliconiines, Danaines, Nymphalines and the females of certain Pierines, all characterised by a peculiar arrangement of the colours red, yellow and black. While these figures are being shown on the screen, I quote from a former description of my own : « The members of this assemblage as it occurs in the northern part of Central America — Guatemala to Nicaragua — present in common a remarkable streakiness of pattern, a feature that makes them easily recognisable among the corresponding forms from other regions of the same continent. Passing on to Venezuela, we find among the geographical races, or, if we like to call them so, the representative species, that there replace the Central American forms, a tendency to the breaking-up of the streaks, and a slight encroachment of the red ground-colour upon the yellow of the apex. In Trinidad there occurs a general paling of the ground-colour, due to an increase of yellow pigmentation, and running, as before, through the entire group. Next, taking the corresponding Guiana forms, we find a further breaking-up of the streaks into spots, and also a general darkening, especially of the hindwings, which gives a most characteristic aspect to the whole assemblage. In East Brazil we have a modification which somewhat recalls the Trinidad facies, though here the yellow streak on the hindwing is better defined, and a pale spot makes its appearance on the apex, the dark area of which is less broken up. At Ega, on the Upper Amazon, a curious dark chestnut tinge pervades the group, while in Peru a characteristic spottiness takes the place of the streaky pattern we saw elsewhere, and the apex becomes more uniformly dark. Finally, in Ecuador the streaks have all but disappeared, and even the spots have become almost blocked out by a dark infusion which now occupies, not only the apex, but also a large part of the base of the forewing, and the whole, or nearly so, of the hindwing. After a little study of some of the typical members of each of these geographical groups, it becomes easy to pronounce, with a considerable degree of confidence, upon the local habitation of a species that we may never have met with before. »

There are two genera of African Pierines, *Mylothris* and *Phris-*

sura, not very nearly allied to one another, but exhibiting in many of their species, or geographical races, a curious parallelism. Nearly every form of *Mylothris* has its own copy among the forms of *Phrissura*; and exactly as in the instance of the South American assemblage we have just been examining, the changes observed in passing from one portion of the African continent to another are alike in the corresponding forms of the two genera. Thus, as is shown by these lantern illustrations, *Mylothris narcissus* is associated in East Africa with *Phrissura lasti*, both being Butterflies with lemon-yellow hindwings and black marginal spots. A form of *Mylothris* from Uganda, white with a dark apex to the forewing, a row of dark marginal spots on the hindwing, and a basal patch of bright orange on the forewing, is accompanied by a form of *Phrissura* (*P. sylvia*) showing the same characters of colour and pattern. In the Congo region we find a form of *Mylothris* (*M. asphodelus*) similar to that just mentioned, except that in the basal patch the orange is replaced by lemon-yellow; and from the same region comes *Phrissura perlucens*, in which exactly the same change has taken place. Tropical West Africa has a form of *Mylothris* (*M. bernice*) in which the patch of basal orange takes on a darker tinge and is somewhat modified in shape. In both these respects the *Mylothris* is followed by a form of *Phrissura* found in the same locality. Lastly, there are parallel pairs of the same genera, inhabiting respectively the same localities, which show a curious barring or striping of the marginal area, accompanied in one instance by a brown coloration of the forewing, affecting the representatives of both genera.

These instances — and it would be easy to multiply them — derive their principal interest from the special resemblances, often, to our view, minute, which obtain between pairs or assemblages of different species, and which change in an identical manner when we pass from one locality to another.

Taking a more general view, we cannot avoid noticing that certain distinct systems of colouring are broadly characteristic, though with modifications, of certain definite large areas of the earth's surface. Anyone, for example, seeing a Butterfly with a uniformly dark coloration, the forewing being crossed diagonally by a crimson band (as in the representations here shown of a *Heliconius*, *H. guaricus*, and two Pierines, *Pereute leucodrosime* and *P. charops*) would in nearly every case be right if be pronounced them to be natives of the Neotropical Province, that is to say, of Central or South America. So too, the general aspect of *Mylothris*

is shared not only (as we have seen) by *Phrissura*, but also by members of several other distinct genera; but all these are African. Another very recognisable type of pattern is common to several species of *Danainæ* and the females of many species of *Nepheronia*; this type is found in the Oriental and Australian Provinces, but nowhere else on the globe. It is quite true that we come upon occasional instances of the occurrence of types resembling some of these local developments of pattern in far-removed regions of the earth's surface; but such case are very rare, and in most instances may in all probability be fairly put down as accidental. There is, for example, a curious little South American Nymphaline, *Cybdelis mnasylus*, which looks very much like a miniature version of the Indian *Hypolimnas bolina*. But the hardiest framer of theories would scarcely venture to suggest any special bionomic significance in a phenomenon of this sort. It may legitimately be set down as a coincidence. The case, however, is widely different when we contrast with sporadic occurrences such as this the enormous number of instances in which the forms that so closely resemble each other inhabit the same localities, the extensive « homœochromatic » combinations all changing together as one passes from one part to another of the same continent; and also when we consider the wide prevalence, throughout a given region, of a characteristic pattern like the dark ground-colour with a crimson band of Central and South America. The facts are undeniable; their interpretation may be in doubt, but to deny that there can be any underlying principle to regulate such phenomena as these would argue a scepticism so extreme as to pass the proper limits of scientific method.

Now let us turn to a fresh series of considerations. We have already noticed the fact of sexual dimorphism in its relation to the phenomena of mimicry. There is another kind of dimorphism, examples of which are not unknown among the Butterflies of temperate regions, though its full development must be sought in the tropics. I refer to the changes which are observed in successive generations of the same Insect in correspondence with the change of season, from hot to cold or from dry to wet. An instance of this seasonal dimorphism probably well known to all is furnished by the European *Araschnia prorsa-levana*, the spring and summer emergences of which Butterfly differ so completely in aspect that it seems at first sight impossible to believe that they can be conspecific. Equally strange instances abound in the tropics, and their number has within recent years been increased by the researches

in especial of Mr. G. A. K. MARSHALL, who has proved by breeding that some of the forms of the genus *Precis*, most distinct from one another in aspect, are nevertheless related to one another as offspring to parent. One of the most remarkable of these instances, *Precis octavia-natalensis* and *P. sesamus*, is here shown on the screen. It has also been proved by the same indisputable evidence that, in many cases, forms of African *Pierinæ*, notably in the genus *Teracolus*, which had previously been described and named as distinct, were merely seasonal phases of the same species. In very many, probably most, of these examples of seasonal dimorphism as exhibited by tropical Butterflies, the dry season phase is far more closely assimilated in aspect to its inanimate surroundings than is the wet; in a few instances, while the dry season form is well concealed when reposing among dead leaves or on the ground, the wet season form of the same species is comparatively conspicuous, and bears more or less resemblance to another Butterfly of remote affinity. On the other hand there is a case where the model (*Mylothris agathina*) is sexually, not seasonally dimorphic. One of its mimics (*Belenois thysa*) is both seasonally and sexually dimorphic. The male of *Belenois thysa* copies the same sex of the *Mylothris* in both seasons, but much better in the dry season than in the wet; while the female *Belenois* is a close mimic of the female *Mylothris* in the dry season, but frequently departs altogether from its model in the wet.

We have learned then that in seasonal, as in sexual dimorphism, it may happen that one phase of the species may be mimetic and the other not.

Let us now turn to the consideration of the actual nature of the resemblances themselves. The outstanding feature which must strike everyone who gives them his attention is, that they are purely superficial. Take the case of *Limnas chrysippus*, the female of *Hypolimnas misippus*, and the *trophonius*-form of the female of *Papilio dardanus*, three Butterflies which we have already noted as presenting a remarkable and even deceptive likeness in general aspect. One of these Butterflies is a Danaine, another is a Nymphaline, and the third a Papilio. I need hardly remind any of my present audience that each of these groups is characterised by certain features, which are called «structural», belonging especially to the segments and appendages of the legs, and to the number and arrangement of the veins in the wings. But do we find any mutual approach in these structural particulars corresponding to the very striking assimilation in obvious aspect? We do not; and

the same remark will apply to every one of the cases that we have had under observation. Not only in the instances of resemblance between Insects of different Orders, as between Hymenoptera and Diptera, but also where the affinity is much closer and the divergence in structure is comparatively slight, we never encounter the smallest indication that the process of assimilation involves anything but superficial and easily recognisable features. Less obvious external characters and all the details of internal organisation remain unaffected, except in so far as they may assist the superficial resemblance. If there is any significance at all in the phenomena under discussion, we seem led to the conclusion that they must stand in some relation or other to the faculty of vision.

Akin to the foregoing point is the fact that in the establishment of a mimetic resemblance, the same broad and visible effect is often produced by different means. It has been established, for example, that although certain South American Pierines, as we have seen, are excellent copies of the red, yellow and black Ithomiines and Heliconiines of the same region, the red and yellow pigments of the Pierines are chemically distinct from those of their models. A still more striking illustration of the same principle is due to an interesting investigation by Prof. POULTON. There is a large number of cases in which the resemblance is in great measure dependent on an acquired, or rather secondary, transparence of an originally opaque wing. It might have been expected that this quality of transparence had been in all cases brought about in the same manner, the visual effect being practically identical. But POULTON has shown that « whereas in the Ithomiines the transparence is due to an alteration in *shape* and diminution in *size* of the minute scales which normally clothe the wing, in the Pierines the same effect is produced by a mere diminution in size, the shape remaining unaltered. The Danaines [which enter into this combination] owe their transparence to a reduction in the *number* of the scales, not to any alteration in shape or in size; while in the associated Moths the effect results, not from any change in size, shape or number of the scales, but from the fact that the individual scales themselves become transparent, and are sometimes set up vertically, so as to let the light pass between them » (the Author, in « Nature » for October 31st, 1907, p. 675). Here then we have another proof that the assimilation does not extend further than to easily obvious features.

A further point that soon impresses itself upon the observer of the phenomena of mimicry is this : that the resemblances which

present themselves to his notice differ widely among themselves in respect of completeness. In some instances the superficial likeness between two Insects is marvellously close, extending to the most minute particulars. This may happen even when the affinity between the two is remote. BATES was so much impressed with the excellence of the resemblance in some cases, that he speaks of « a minute and palpably intentional likeness which is perfectly staggering ». This phrase, especially the use of the word « intentional », is no doubt open to criticism ; but most students, for example, of the neotropical lepidopterous fauna will admit its virtual accuracy. In other cases the resemblance, though sufficiently arresting, is less exact. In a further series of instances a resemblance, while certainly present, may be of so remote a kind that opinions may legitimately differ as to whether it possesses any bionomic significance at all. Between the two extremes every degree of transition is found to exist. I show on the screen specimens of *Heliconius aranea* (underside), *H. leuce*, *H. alithea* (underside) and *H. galanthus* (underside), together with *Perrhybris lorena* ♀ (underside), *Pieris noctipennis* ♀ and *Pieris locusta* ♂ (underside). Here we see examples of resemblance between *Heliconius* and Pierine as to the significance of which I am quite prepared to find that different views might be taken, though I am myself for various reasons inclined to the opinion that the likeness is what BATES would have called « intentional ». Some, again, may be disposed to doubt whether the Danaine here exhibited (*Melinda formosa*) bears more than an accidental resemblance to this *Papilio* (*P. rex*). The individuals before us are, however, both males, and their respective females, though easily recognisable as each belonging to its own male, show a mutual resemblance which is really close. I may mention that both sexes of each species, with other most interesting forms, have been well figured in « Trans. Ent. Soc. Lond., 1906 », pl. XI, and by Mr. ELTRINGHAM in his fine work on African mimicry just published.

In many cases there exists a resemblance, not to any other Insect in particular, but to a group or assemblage in general. In all these instances, it is perhaps superfluous to mention, there is no necessary dependence on affinity. But that, as before suggested, the influence of affinity cannot be entirely ignored, we see from such an example as that of the African *Acrœas*, many species of which are superficially so much like one another that it requires a skilled observer to distinguish between them. The same may be said of many of the Eastern *Euplœas*. Contrast this

with a group of the European *Vanessas*. These are probably as nearly allied to one another as are the *Acræas* and *Euplœas*, but though presenting in common the characteristic *Vanessa* facies, they are distinguishable from one another at a glance. There is therefore in all probability some other factor at work in bringing about the resemblance between the members of these tropical groups besides that of mere affinity.

Certain other points remain to be noticed before we can be quite sure that we are in possession of all the data needful for an explanation. It is no doubt natural to enquire as to the comparative numbers of the various forms concerned. The answer here is perfectly definite; sometimes one of a pair, or several of an assemblage showing a common aspect, is much rarer than the rest; also it often happens that some one form of the combination is much more abundant than any other constituent of the association. But on the other hand there are plenty of cases in which most, if not all, of the mutually resembling forms are common. This fact was a great puzzle to BATES, as it plainly did not fit in very comfortably with his theory. On this point I shall have more to say before concluding.

Once more; we find that these mimetic assemblages or combinations, so to call them, are not sharply marked off from one another, but show frequent passages from one to another by almost imperceptible gradations. Take for instance such a series at that now shown on the screen, which might be considerably extended. The *Papilio* at the top (*P. iphidamas*) and the *Heliconius* at the bottom (*H. venusta*) are each of them members of a large mimetic association. The yellow patch on the forewing is common to both, though its shape and position on the wing show differences; in other respects the patterns exhibit much divergence. But the three intermediate Butterflies (*Euterpe approximata*, *E. bellona*, and *E. nigrina* [underside]), which are all Pierines, show an array of connecting links which enables us to pass by an easy gradation from one extreme of the series to the other. This is only a single example of a state of things, which is constantly to be met with in the lepidopterous fauna of tropical regions.

What then have we learned in the course of this brief survey? The points may be summed up as follows :

1. The cases of resemblance between distinct kinds of Insects are very numerous — too numerous to be accidental.

2. These resemblances are to a very great extent independent of

affinity. Some of the most striking are those between Insects of different orders.

3. They are peculiarly liable to occur in Insects of the female sex.

4. They are, speaking generally, found only between the inhabitants of the same region.

5. They may affect one phase of a seasonally dimorphic Insect differently from the other.

6. No structure or detail of organisation is involved in these resemblances except in so far as a modification therein may assist in producing a superficial likeness in aspect or behaviour.

7. In the production of these resemblances the same effect is often brought about by different means.

8. Every transition exists between a likeness, which is so remote as to be fairly disputable, and a resemblance, which may even deceive a skilled observer.

9. In some cases there may be great disparity in point of numbers between the forms linked together by community of aspect. In other cases the numbers may be nearly equal.

10. The combinations of two or more forms resembling one another are in many cases not isolated, but are often connected with other combinations by a more or less complete series of gradations.

So far we have been concerned with facts. What is to be said about their explanation? We have already seen that these cases of resemblance are too numerous to be reasonably considered accidental; moreover their evident relation with conditions of sex, locality and visibility seems of itself to forbid such an interpretation.

When we consider the fact of the limitation of a given system of pattern and coloration to a particular area of the earth's surface, and especially when we examine the changes that affect a mimetic assemblage in common as we pass from one portion to another of such an area, as in the series just now exhibited of successive modifications undergone by the same general type of coloration in the passage from Guatemala to Peru, we are tempted to conjecture that geographical conditions may have some bearing on the matter. We may remember that many arctic Animals are white, and that both Birds and Mammals inhabiting desert regions are frequently assimilated in colour to their sandy surroundings. But if we attempt to find in these circumstances an analogy with the phenomena under present discussion, we are at once confronted with difficulties that may well appear insuperable. The prevailing coloration of Animals that live amid snow and sand respectively is with high

probability attributed, not to the direct influence of their surrounding conditions, but to the advantage they gain from concealment whether from enemies or from prey within their respective environments, their community of coloration being, to use Prof. POULTON's term, syncryptic. But though Mr. ABBOTT H. THAYER, who surveys the subject from the point of view of an artist, maintains that the variegated patterns of the Butterflies in question similarly aid concealment, I do not think that naturalists in general will find his arguments on this head convincing. At any rate his contention does not accord with my own experience in the tropics. But even if his theory be sound with regard to Butterflies, it will not account for the resemblance of a Moth to a Hornet, or of a two-winged Fly to a Carpenter-bee. It will scarcely be denied that both Hornet and Carpenter-bee are even aggressively conspicuous. And what are we to say to the case of a Locustid, which is, so to speak, painted to look like an Ant, or to that of a Membracid, which screens itself beneath a sculptured representation of a similar model? These are not cases of syncryptic modification; nor is it conceivable that the direct influence of external conditions, even if they are similar (which may be doubted), can impose a deceptive picture or piece of sculpture upon the body of an otherwise unaltered Insect. Take again the case of a Butterfly like *Papilio dardanus*, the subject of female polymorphism. Community of external conditions can scarcely be appealed to in order to explain the likeness between each form of the female and a distinct species of Danaine, when the individuals of the same brood of the *Papilio*, all presumably exposed to the influence of identical conditions, have diverged along these three or four different channels. Taking all the facts into consideration, we must, I think, conclude that the influence of a common geographical environment, whether its influence be directly or indirectly exercised, fails to explain the phenomena of mimicry.

A view that has often been put forward, and maintained with great ability, attributes these resemblances to internal causes, which compel various species to pass through similar phases of development. These phases, it is held, must from time to time coincide, and so we may get between distinct forms a correspondence in aspect, which will present the appearance of mimicry. As a rough illustration of this view we may suppose a series of kaleidoscopes, each furnished with a similar set of fragments of glass, and all undergoing rotation together. From time to time it may no doubt happen that the patterns shown by two or more of the instruments

will practically coincide. But the application of any such principle to the phenomena of Insect mimicry is attended with serious difficulty. The cases to be explained are not scanty in number, but abundant. Then again, many of the resemblances occur, as we have seen, between Insects widely separated in point of affinity. Take the Lycoid assemblage that we have previously mentioned. Is it probable that Beetles, Braconids, Wasps, Bugs, Moths and two-winged Flies should all have been impelled by internal causes to reach the same stage of colour-development at the same epoch of their phylogenetic history? And if this be considered not impossible, why should the various members of this assemblage be all found together in the same place, many of them actually on the same tree? We have already given attention to the fact that the forms resembling each other are as a general rule inhabitants of the same localities. It is not by any means clear how this is to be explained on the theory of internal causes of similar development. It is true that, as we have seen, there are sporadic cases of resemblances that have to all appearance developed independently of one another. But why should they be so few in comparison with the enormous number of instances, which occur under the conditions of a common habitat? There is no apparent reason, under the theory of internal causes, why there should be any connection between the likeness and the locality.

Those of my audience who happen to be acquainted with my writings on this subject, will have anticipated the solution of the problem which I should myself favour. I should find myself in agreement with Mr. THAYER to the extent of believing, with him, that these resemblances are of service to the forms exhibiting them, and that their establishment and survival have taken place under the control of natural selection. But I cannot follow him in the opinion that all the patterns which we have been considering, and which are so widely adopted by Insects of such different affinities, are calculated to render their possessors invisible against their background. On the contrary, and I think the experience of most observers will here bear me out, it appears to me that the Butterflies, which exhibit these brilliant and variegated colours, are for the most part conspicuous on the wing. Moreover, many of them adopt a slow, deliberate mode of flight, which seems to court observation. This is certainly the case with members of the genera *Mylothris* and *Amauris,* and with several of the *Acræas*. We have now a good deal of evidence that some of these forms are unpalatable to certain Birds, and are at any rate not taken by preference.

Probably no form is absolutely immune; it should always be recognised that these matters are relative. But it seems to be clearly established by observation and experiment that some Birds at all events avoid some of these conspicuously marked Butterflies, and that there are various degrees of preference. Certain observers, it is true, have denied that Butterflies are fed upon by Birds at all, but there exists now a considerable body of evidence to the contrary. This being so, we are led to the conclusion that the brilliant colours of these Insects are, to use Prof. POULTON's term, « aposematic », that is to say that they are warning marks, which signify to insectivorous enemies such as Birds the presence of some quality whether of taste, or of odour, or of toughness, which makes their possessors unsuitable for food. If this conclusion is well grounded, we can find in the theories of BATES and of FRITZ MÜLLER a sufficient explanation of the significance of mimicry. BATES pointed out, just upon fifty years ago, that a palatable Insect might escape attack by sailing under the false colours of an inedible species, and he was followed about twenty years later by FRITZ MÜLLER, who called attention to the fact that if Birds had to pass through an education in order to learn by trial what Insects to capture and what to avoid, the combination of unpalatable Insects into mimetic associations would protect each constituent of such an assemblage from a certain amount of experimental tasting. It has been shown, chiefly by Prof. LLOYD MORGAN, that this education of young Birds in what to eat and what to avoid is a reality and no mere assumption; and the theory of FRITZ MÜLLER may thus be said to rest on a substantial foundation. The first of these theories, that of BATES, is the theory of what may be called true mimicry. That of FRITZ MÜLLER, as has been pointed out by Prof. POULTON, is more correctly designated as *synaposematism,* or the adoption by two or more forms of a common warning pattern.

Opinions may legitimately differ as to the relative importance of these two theories; and until more data are at our disposal, it will be possible to doubt as to which of them is applicable to this or that given instance. But the theories are complementary to one another, and not mutually exclusive. And it is to be observed that both of them, equally with that of THAYER, imply the preservation, by natural selection, of appropriate variations. Let us now see how far these theories are in accordance with the facts with which we started.

1. In the first place, it is obvious that the abundance of cases

constitutes no objection. If it be granted that the possession of a common pattern is advantageous, there is no reason why its adoption should not be of frequent occurrence.

2. Nor is the fact that the resemblances are largely independent of affinity adverse to the theories of BATES and MÜLLER. Natural selection will work upon any material that comes to hand, quite irrespective of its taxonomic relations.

3. That the female sex should be more liable to enter these associations is also to be expected. It is a matter of common observation that the female of many Birds and other Animals is better protected from attack by coloration and habits than the male; no doubt, as was pointed out by WALLACE, because the life of the female, as guardian of the future brood, is especially valuable to the species. Prof. POULTON has also drawn attention to the fact that the female, being in Butterflies often more subject to individual variation than the male, gives greater scope to the operation of natural selection.

4. The fact that the forms resembling each other are usually found together, finds a ready explanation; inasmuch as it implies that they have been exposed to the attacks of the same enemies. Otherwise, the adoption of a common aspect would carry no benefit.

5. With regard to seasonal dimorphism, it is generally found that the dry-season phases, which occur when Insect-life is scarce and competition among Insect-eaters is keen, are better protected than the wet-season phases of the corresponding species. Hence, we need not be surprised to find that in some cases the wet-season phase is mimetic, while the dry-season phase adopts for its protection what is probably the more efficient method of cryptic coloration. Nor, again, is it surprising that a Butterfly like *Belenois thysa*, which is mimetic in both seasons, becomes much more strongly so in the dry.

6. The fact that the changes from the normal are all in the direction of a resemblance that is merely superficial, is strongly in favour of the theories. For these superficial modifications are plainly an appeal to vision, and it is not easy to conjecture what alien vision can be of importance to these Insects, except the vision of their actual or potential enemies.

7. That the same apparent effect is often brought about by different means is quite characteristic of natural selection; which, as we have already seen, proceeds by adopting any means that offer, irrespective of affinity, homology, or any similar consideration.

8. The existence of every transition between resemblance which is practically complete and resemblance which is so slight as to be even disputable, is exactly comparable with what may be observed in other modes of protection; as for instance in cryptic assimilation to the ground, leaves, twigs, bark or other indifferent objects. These matters, as has been so often stated, are relative. Probably no means of protection gives absolute security, but different grades exist; as indeed we should expect on any theory of evolution. And it is often observable that where one kind of protection is feeble, it is compensated for by excellence in another method.

9. The fact that forms resembling each other may be severally common, is to some extent an objection to the application to such cases of the theory of BATES, which is usually considered to postulate the comparative scarcity of the mimic. It is, however, no obstacle in the way of synaposematism; for each accession of inedible individuals only tends to increase the common safety.

10. So too, the fact, that the associations are connected with one another by intermediates, is consonant with the theory of natural selection; for these gradational forms may be looked upon in effect as sign-posts showing the course which the evolutionary process has taken. Their survival is quite explicable on the Müllerian theory; for if themselves distasteful, each transitional form would be capable of sharing protection with the nearly resembling forms on each side of it, and thus would be established a chain of mutually protective links, reaching from one inedible assemblage to another.

I am not sanguine enough to suppose that everyone in my audience will agree with the interpretation of these phenomena, which I have ventured to advocate. I must be content with having tried to put the case of those theories, which seem to me to account for the facts better than any others that have yet been developed. And I would urge in conclusion, as I did at the outset, that the data, about which there should be no dispute, are interesting and curious in the highest degree. Any rival explanation, which neither neglects nor distorts the actual facts of the case, will deserve and, I am sure, will receive the closest attention of all scientific naturalists.

EXTRAIT du *Ier CONGRÈS INTERNATIONAL D'ENTOMOLOGIE*, 1910

On Dr. C. A. Wiggins' Researches on Mimicry in the Forest Butterflies of Uganda (1909),

by EDWARD B. POULTON, F. R. S.,
Hope Professor of Zoology in the University of Oxford, Fellow of Jesus College, Oxford.

The object of the present paper is to investigate the numerical and other relations between the models and mimics of three interesting associations, each grouped around one or more species of the Acræine genus *Planema*. The whole of the material was captured, between May 23rd and August 31st, 1909, in patches of native forest within a few miles of Entebbe, Uganda. The examples themselves are well known, the most important having been described by Mr. S. A. NEAVE, M. A., B. Sc., in 1904 (1) and 1906 (2). The instances of mimicry unrecognised at the time of Mr. NEAVE's memoirs have been described by Mr. HARRY ELTRINGHAM in his monograph on Mimicry in the Butterflies of Africa (Oxford, « Clarendon Press », 1910), where beautiful coloured illustrations of nearly every form mentioned in the present paper will be found.

(1) « Nov. Zool. », vol. XI, pp. 323-363.

(2) « Trans. Ent. Soc. Lond. », 1906, pp. 207-224.

Mr. NEAVE's two papers owed their existence to the generosity and energy of my friend Dr. C. A. WIGGINS of Entebbe, and the present paper is equally due to his kindness. Dr. WIGGINS has, in part by his own efforts, in part by the employment of native collectors, obtained collections of Forest Butterflies on a large number of dates. These collections are ample enough to enable the enquirer to judge of the numerical relationships. Special care was taken to eliminate, as far as possible, the natural preferences of the collector for one species rather than another. Dr. WIGGINS' own captures are clearly distinguished from those of the natives in the columns of the following tables. Upon Dr. WIGGINS has fallen the severe labour of recording the data of time and place with precision, and packing the collections so that no mistake in interpretation could be made.

My assistants in the Hope Department of the Oxford University Museum, and Mr. A. CANT, who has given most efficient help in the « setting », have worked hard and successfully to render the data permanent and these great collections available for the student. I wish particularly to thank my friend Mr. H. ELTRINGHAM for very much kind help in unpacking, determining and recording the collections, and Dr. KARL JORDAN for his valuable opinion on some of the most difficult of the species.

The present paper is only an instalment; for Dr. WIGGINS has most kindly promised to continue his important work until the conclusions derived from material collected during certain months have been tested by collections made in the same period of another year. But I have not wished to withhold the whole of the results until his work is complete, and I have chosen the First International Entomological Congress as the occasion on which to bring forward this preliminary statement.

The three *Planema*-centred Combinations, which form the subject of this paper, are by no means the only mimetic associations in the forests near Entebbe. Thus the species of the Danaine genera

Amauris and *Danaida* furnish dominant models, as do species of *Acræa*, and the Geometrid Moth, *Aletis*. I have chosen the *Planema*-centred Combinations in the belief that they shed more light than any of the others on various aspects of mimicry : on the relation of mimicry to sex, on polymorphism in mimicry, on secondary mimicry or the resemblance to a mimic rather than to its primary model, on the Batesian and Müllerian hypotheses. Apart from these interesting but elaborate questions, the evidence here brought forward will perhaps satisfy those who are still doubtful, that the models and mimics tabulated in the present paper do habitually fly together on the same days and in the same forests.

I now propose to set forth in three tables the specimens of the three *Planema*-centred Combinations, taken between May 23rd and August 31st, 1909 :

TABLE I

CONTAINING MEMBERS OF COMBINATION I, CENTRED BY *Planema poggei nelsoni* AND THE MALE OF *Planema macarista*.

CAPTORS AND DATES OF CAPTURE IN 1909.	Primary models, belonging to the Acræine genus *Planema*.		Acræine mimic with its non-mimetic male.		Nymphaline mimics.			Papilionine mimic : a female.	Totals.
	Male of *Planema macarista*.	Male and female of *Planema poggei nelsoni*.	*Aurivillii* female of *Acræa alciope*.	Non-mimetic male of *Acræa alciope*.	Male of *Pseudacræa hobleyi*.	Male and female of *Pseudacræa kuenowi hypoxantha*.	Male and female of *Pseudacræa albostriata*. The mimetic variations are marked « M ».	Female f. *planemoides* of *Papilio dardanus dardanus*.	
C. A. Wiggins, May 23rd	»	»	2	»	1	»	»	»	3
— — 24th	3	»	1	2	2	»	1	»	9
— — 30th	2	»	1	»	»	1 ♀	»	»	4
— — 31st	1	»	1	1	1 [1]	»	3	»	7
One *Ps. albostriata* capt. by Native.									
C. A. Wiggins, June 13rd	»	»	»	2	1 [2]	»	»	»	3
— — 27th	1	1 ♂	1	2	3	»	4 (1 M.)	1	13
— — 29th	1	»	»	2	2	»	3 (1 M.)	»	8
— July 11th	1	1 ♂ 1 ♀	»	1	2	»	»	1	7
C. A. Wiggins, July 18th	»	»	»	2	2 [3]	»	»	1	5
— — 24th	»	»	1	2	»	»	»	»	3
Native collector, August 4th	»	»	1	»	1	»	»	»	2
— — 6th	2	»	»	»	1	1 ♂	»	»	4
C. A. Wiggins (9) — 7th Native collector (5).	9 (native 2)	»	1 (native	2 (native)	1	»	1	»	14
Native collector, August 9th	»	»	4	2	»	»	»	»	6

— — 11th.	2	»	3	»	»	»	1 (1 M.)	»	6
— — 12th.	»	»	2	1	2	»	»	»	5
— — 13th.	1	»	1	1	1	»	»	»	4
C. A. WIGGINS, — 14th.	9	1 ♂	3	1	3	»	»	1	18
Native collector, — 16th.	»	1 ♂	4	1	1	»	»	»	7
— — 17th.	3	1 ♂	4	2	1	»	»	»	11
— — 18th.	1	»	4	2	1	»	1	»	9
— — 19th.	3	2 ♂	1	1	2	»	»	»	9
— — 20th.	3	»	3	2	»	»	»	»	8
— — 21st.	1	1 ♂	4	2	»	»	»	»	8
C. A. WIGGINS (9) — 22nd Native collector (2).	2 (native 1)	»	3	»	4 (native 1)	»	2	»	11
Native collector, August 24th.	2	»	1	1	»	»	»	»	4
— — 25th.	7	1 ♂	»	»	»	»	3	»	11
— — 26th.	6	»	»	»	»	»	»	»	6
— — 27th.	3	»	1	»	»	»	1	»	5
— — 28th.	6	»	»	»	1	»	»	»	7
C. A. WIGGINS (9) — 29th. Native collector (6).	12 (native 3)	»	»	»	2 (native)	»	1 (native)	»	15
Native collector, August 30th.	»	»	1	»	1	»	»	»	2
— — 31st.	»	1 ♂	»	»	»	»	»	»	1
TOTALS	81 (4)	12	49 (5)	35	36 (6)	2	21 (7)	4	240

(1) The anal area of both hind wings shorn off symmetrically.

(2) The bar crossing the hind wings of this specimen, of one of the two captured June 29th, and one August 4th, is fulvous and not white on the upper surface : on the under surface it is of the normal white.

(3) One of these specimens is a female with the colouring of a male; the other — evidently a mimetic male of the usual form — is represented by a right fore wing found upon the ground.

(4) The females are the principal primary models of Combination II.

(5) In addition to these *aurivillii* females, 2 examples of a modified western type of female were taken on August 14th and 1 on August 18th.

(6) The females enter as mimics into Combination II. See however note 3.

(7) It is to be noted that there are only 3 incipient mimics in these 21 specimens.

TABLE II

CONTAINING MEMBERS OF COMBINATION II, CENTRED BY THE FEMALE OF *Planema macarista* AND OF *Planema alcinoe*.

CAPTORS AND DATES OF CAPTURE IN 1909.	Primary models, females of the Acræine genus *Planema*, with the male of one, not mimicked at Entebbe.			Acræine mimics, primary and secondary, with their non-mimetic males.				Nymphaline mimic: a female.	Totals.
	Female of *Planema macarista.*	Female of *Planema alcinoe.*	Male of *Planema alcinoe.*	*Carmentis* f. of female of *Acræa jodutta.*	Non-mimetic male of *Acræa jodutta.*	White-marked female of *Acræa althoffi.*	Non-mimetic male of *Acræa althoffi.*	Female of *Pseudacræa hobleyi.*	
C. A. Wiggins, May 23rd	»	1	»	»	1	»	»	»	2
— — 24th	»	»	»	1	»	»	»	»	1
— — 30th	1	»	»	»	1	»	»	2	4
C. A. Wiggins (2), May 31st Native collector (1).	»	»	»	1 (native)	1	»	»	1	3
C. A. Wiggins, June 27th	»	»	»	»	»	»	»	1	1
— — 29th	2	»	»	»	4	»	»	»	6
— July 11th	1	»	»	1 ([1])	1	»	»	1	4
— — 18th	»	»	»	1	3	»	1	»	5
— — 24th	»	»	1	1 ([2])	3	»	1	»	6
C. A. Wiggins (5), August 7th Native collector (8).	5 (native 2)	2 (native)	1	1	2 (native)	»	1 (native	1 (native)	13
Native collector, August 10th	1	»	»	3	2	»	»	1	7
— — 11th	»	»	1	3	2	»	»	»	6
— — 12th	»	»	»	2 ([3])	4	»	»	2	8
— — 13th	»	»	»	3	3	»	»	1	7
C. A. Wiggins, — 14th	5	2	5	1	»	»	1	1	15

Native collector,	— 16th	1	»	»	5	4	»	»	1	11
—	— 17th	»	»	»	3	6	»	1	»	10
—	— 18th	»	»	»	2	8	»	1	1	12
—	— 19th	1	»	»	2	1	»	»	3	7
—	— 20th	»	1	»	3	3	»	»	1	8
—	— 21st	»	»	2	3	4	»	3	1	13
C. A. WIGGINS (8), Native collector (8).	— 22nd	4 (native 1)	»	2 (native 1)	1 (native)	3 (native 2)	»	3 (native)	3	16
Native collector,	August 24th	2	»	2	6	4	2 (4)	1	1	18
—	— 25th	2	1	1	»	»	»	»	»	4
—	— 26th	»	1	2	2 (5)	1	»	»	1	7
—	— 27th	»	»	2	»	»	»	»	»	2
—	— 28th	1	»	1	»	1	»	»	3	6
C. A. WIGGINS (13) Native collector (8).	— 29th	9 (native 4)	2 (native 1)	7 (native 1)	1 (native)	»	»	»	2 (native 1)	21
Native collector,	August 30th	2	»	2	1	»	»	1	»	6
—	— 31st	2	1	1	»	»	1	»	»	5
	TOTALS	39 (6)	11	30	47 (7)	62 (8)	3 (9)	14 (10)	28 (11)	234

(1) This specimen was captured in July, probably on the 11th. [Certainly July 11th, E. B. P. October 1st, 1911.]

(2) The pale area of the hind wing, extending on to the fore wing, is yellowish and not white, and thus transitional towards the colour of the male.

(3) The hind wing markings approach those of the *tellus*-like forms of female in Combination III.

(4) The pale markings of one of these females are yellow and not white, thus following the male of *A. jodutta* as a model, instead of its female.

(5) Both hind wings of one specimen shorn through symmetrically. The straight line of the cut suggests the beak of a Bird.

(6) The males are the principal primary models of Combination I.

(7) Another form of female, only half as numerous as the *carmentis* form, enters as a mimic into Combination III.

(8) These non-mimetic males, with the exception of 5 captured May 30th and June 29th, are repeated in Combination III, which contains 9 additional specimens taken August 9th and 10th.

(9) It is to be noted that 2 out of these 3 specimens are secondary mimics of the *carmentis* female of *A. jodutta*, rather than mimics of the two primary *Planema* models. The third *althoffi* female mimics the male *jodutta* : see note 4. A commoner form of female *althoffi* enters as a mimic into Combination III.

(10) These males, with the exception of that captured on August 30th, are repeated in Combination III, which contains an additional specimen taken on August 9th.

(11) The males, together with a single female with male colouring, enter as mimics into Combination I.

TABLE III

CONTAINING MEMBERS OF COMBINATION III, CENTRED BY *Planema tellus platyxantha.*

CAPTORS AND DATES OF CAPTURE IN 1909.	Primary model, *Planema* (*Acræinæ*). — Male and female of *Planema tellus platyxantha.*	Acræine mimics, primary and secondary, with their non-mimetic males. — *Tellus*-like f. of female of *Acræa jodutta.*	Non-mimetic male of *Acræa jodutta.*	Fulvous-marked female of *Acræa althoffi.*	Non-mimetic male of *Acræa althoffi.*	Nymphaline mimic : male and female. — Male and female of *Pseudacræa terra.*	Papilionine mimic : a female. — Female f. *niobe* of *Papilio dardanus dardanus.*	TOTALS.
C. A WIGGINS, May 23rd	1 ♀	»	1	»	»	»	»	2
— — 24th	»	»	»	1	»	1 ♀	»	2
— — 31st	1 ♂	1	1	»	»	1 ♂	»	4
— June 27th	2 ♂	»	»	»	»	»	»	2
— July 11th	2 ♂ 1 ♀	»	1	»	»	2 ♀(1)	1 (2)	7
— — 18th	»	»	3	»	1	»	»	4
— — 24th	»	2	3	»	1	»	»	6
Native collector, August 6th	1 ♂	»	2	»	»	1 ♂	»	4
C. A. WIGGINS (12), August 7th Native collector (11).	18 ♂ (native 7)	1	2 (native)	»	1 (native)	1 ♀ (native)	»	23
Native collector, August 9th	»	1	7	»	1	»	»	9
— — 10th	3 ♂	2	2	»	»	»	»	7
— — 11th	1 ♂	3	2	»	»	1 ♀	»	7
— — 12th	3 ♂	»	4	»	»	1 ♀	»	8
— — 13th	2 ♂	»	3	1	»	1 ♂	»	7
C. A. WIGGINS, — 14th	8 ♂ 5 ♀	»	»	»	1	3 ♀(3)	»	17

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] collector, — 16th	1 ♂ 3 ♀	2 (4)	4	»	[illegible]	[illegible]	[illegible]	10
— — 17th	»	2	6	»	1	»	1	10
— — 18th	2 ♂	3	8	»	1	»	»	14
— — 19th	5 ♂	»	1	»	»	»	»	6
— — 20th	2 ♂	»	3	»	»	»	»	5
— — 21st	3 ♂	1	4	1	3	»	»	12
C. A. WIGGINS (9), August 22nd Native collector (5).	4 ♂	»	3 (native 2)	1	3 (native)	2 ♂ 1 ♀	»	14
Native collector, August 24th	2 ♂ 1 ♀	3 (5)	4	1	1	1 ♂ (6)	»	13
— — 25th	3 ♂ 2 ♀	»	»	1	»	»	»	6
— — 26th	1 ♂	»	1	»	»	»	»	2
— — 27th	1 ♂	»	»	»	»	1 ♀	»	2
— — 28th	»	»	1	1	»	1 ♂	»	3
C. A. WIGGINS (6), August 29th Native collector (7).	10 ♂ 1 ♀ (nat. 5 ♂)	1 (native)	»	1 (native)	»	»	»	13
Native collector, August 31st	»	1	»	»	»	»	»	1
TOTALS	89 (75 ♂ 14 ♀)	23 (7)	66 (8)	8 (9)	14 (10)	18	2	220

(1) One of these specimens was captured in July, probably on the 11th. [Certainly July 11th, E. B. P. Oct. 1st, 1911.]

(2) Captured together with the female *Planema tellus platyxantha* in a single sweep of the net.

(3) One of these females is transitional towards the form *Ps. obscura* NEAVE.

(4) One of these females is a very dark form with the fulvous markings greatly reduced.

(5) On this date, and on August 11th, 14th and 17th, single examples of a *Danaida chrysippus*-like form of female *A. jodutta* were captured. These forms combine the *tellus*-like pattern with a white subapical bar to the fore wing, like that of the mimetic females in Combination II.

(6) This interesting specimen is transitional, on the under as well as on the upper surface, towards the male of the form *Ps. hobleyi*.

(7) See note 7 on p. 489.

(8) See note 8 on p. 489.

(9) These females are secondary mimics of the females of *A. jodutta* in the same Combination rather than of the primary model *Pl. tellus platyxantha*. See also note 9 on p. 489.

(10) See note 10 on p. 489.

Combination I, centred by *Planema poggei* DEWITZ, subsp. *nelsoni* GROSE-SMITH, **and the male of** *Pl. macarista* E. M. SHARPE **(Table I).**

This deeply interesting association was described by S. A. NEAVE in « Trans. Ent. Soc. Lond. », 1906, p. 218, and its members figured in the accompanying plate X. Two of the mimics figured by the author were not captured in the period now under review and are therefore excluded from Table I: *viz.* a form of *Elymnias phegea* F., and an outlying member, the female of *Precis rauana* GROSE-SMITH. The plate also contains excellent figures of *Pseudacræa kuenowi hypoxantha* JORD., the male of *Ps. hobleyi* NEAVE (1), and the *planemoides* TRIMEN, female form of *Papilio dardanus dardanus* BROWN. The distinction between *Planema poggei nelsoni* and the males of *Pl. macarista* at Entebbe was not recognised, and the former, correctly represented on plate X, figure 1, was supposed to be the only model. The *aurivillii* STAUD. female of *Acræa alciope* HEW., is represented in figure 2 as the male of *Planema aurivillii* (2). The confusion into which all authors had been led by this puzzling mimetic form was finally cleared up by Mr. ELTRINGHAM (3) in 1909 (« Proc. Ent. Soc. Lond. », LXVII-LXIX). The incipient mimicry exhibited by a small proportion of the specimens of *Pseudacræa albostriata* LATHY was also unknown at the time when Mr. NEAVE was writing his paper.

I have already alluded to Mr. ELTRINGHAM's recently published work with its beautiful coloured figures of nearly all the species in all the three tables of the present paper. With these and Mr. NEAVE's excellent uncoloured figures the members of Combination I can be studied under very favourable conditions.

---

(1) By a clerical error printed as *notleyi* on the plate.

(2) Correctly placed as an *Acræa* in the text, p. 218, and description of plate X. p. 223. The author was unfortunately compelled to hurry his departure for Africa at the time when this paper was being brought out, and was unable to spare the time for careful revision.

(3) During the present year, 1911, Dr. G. D. H. CARPENTER has bred 8 *A. alciope* males and 5 *aurivillii* females from 13 small larvæ found on a single leaf of the food-plant on Damba Island in the Victoria Nyanza, near Entebbe.

The two primary *Planema* models of Combination I.

It is noteworthy that, in addition to the differences in form and direction of the bar crossing the fore wing in the two species, the fulvous tint is of a deeper shade in the male *macarista* than in *poggei nelsoni*. It can scarcely be doubted that there has been synaposematic approach between the two models; but their relationship over a much wider range must be studied before a confident decision can be reached. In the forests near Entebbe the male *Pl. macarista* is seen to predominate greatly over the other model, 81 specimens being shown in Table I, as against 12, including a single female, of *Pl. poggei nelsoni*. These proportions are sure to be different, and may even be reversed, in other parts of the common range of the two species. The strongest evidence will however be supplied if it can be shown that one of these models exists in a modified form outside the range of the second, and that the likeness to the other increases when it enters its area It is slightly more probable that *Planema poggei nelsoni*, with both sexes alike, has influenced rather than been influenced by the male *Pl. macarista*.

The striking and peculiar colour-scheme is borne by both sexes of *poggei nelsoni*, while the female of *macarista* possesses an appearance common to several female Planemas.

It is possible that, on its under surface, the male *Planema alcinoe* FELD. is an incipient mimic of the two primary models. A careful comparison between *alcinoe* of Entebbe and of the parts of the west coast, where *Pl. poggei* and *macarista* are unknown, will probably settle the question. In the meantime the male *alcinoe* is placed beside its female, which is a model in Table II.

Acræa alciope HEW. : the *aurivillii* STAUD. female form.

The resemblance of this female *Acræa* to the male of *Planema macarista* is equally remarkable on both surfaces, the basal area of the hind wing under side exhibiting the characteristic Planemoid brown triangle, over which are scattered black spots corresponding to those of the male *alciope*, but larger in size. Certain points in the mimetic association deserve fuller consideration.

When a particular pattern is restricted to one sex in both model and mimic, it is common for the female to resemble a female, the male a male. Thus the likeness founded on similarity of pattern is heightened by similarity in the habits and movements which are characteristic of sex. A good example is afforded by *Pseudacræa hobleyi* with its male mimicking a male *Planema* and its female the female of the same *Planema*. The female of *Acræa alciope* is a well-marked exception to this rule; for on the tropical west coast of Africa it mimics the dark male Planemas of the type of *Pl. alcinoe*, while at Entebbe its *aurivillii* female mimics the male of *Pl. macarista*. There can be no doubt that the western females are ancestral as compared with those at Entebbe; for the displacement of the older form is not complete. Thus, in addition to the 49 *alciope* females recorded in Table I, 2 specimens, captured on August 14th and 1 on August 18th, are modifications of the western type, perhaps altered by incipient mimicry of *Planema tellus platyxantha* JORD., or by secondary mimicry of the *tellus*-like females of *Acræa jodutta* F. The presence of modified western forms of the female *alciope* side by side with its other females, that are mimics of the male *Pl. macarista* and both sexes of *Pl. poggei nelsoni*, is extremely interesting.

Another interesting point is the great relative abundance of the mimic. It will be seen by a glance at Table I on pages 486-487 that 49 mimetic females and 35 non-mimetic males of *A. alciope* were taken in the period under review, together with 93 models : *viz.* 81 males of *Planema macarista* and 12 examples (11 ♂ 1 ♀) of *Pl. poggei nelsoni*. The relative numbers of the mimic, its place in a highly distasteful group of Butterflies, and the fact that its non-mimetic male itself supplies the model for a female Lycænid (*Mimacræa fulvaria* AURIV.) combine to render the *aurivillii* female of *A. alciope* a remarkably striking example of Müllerian or synaposematic resemblance.

The question indeed arises as to whether the whole of this remarkable likeness is to be accounted for by approach on the side of the *Acræa* or whether the male of *Planema macarista* has not itself undergone some diaposematic change in the direction of its mimic. I omit consideration of *Planema poggei nelsoni* to which the *aurivillii* female bears a much less perfect resemblance.

There are two features in the pattern, that is common to the upper surface of all or many *macarista* males and all or many

aurivillii females of *alciope,* which are certainly ancestral in the latter. Whether they are also ancestral in the *Planema* is a matter for future enquiry, involving the examination of long series of local forms of *Pl. macarista* over all parts of its range and the careful comparison of this species with its near allies. With the facts as we know them at Entebbe there are good reasons for believing in a possible diaposematic relationship; but the whole subject is so complex and difficult that I should not venture to make a more definite statement until further investigations have been undertaken.

1. *The broad fulvous band which in many specimens borders the white bar of the hind wing.* — This feature is, in my experience, much commoner in the *Acræa* mimic than in the *Planema* model, but, when it *is* present in the latter, bears the strongest superficial likeness to that of an *aurivillii* female in which the marking is developed to an equal extent. Comparison with the pattern of the male *alciope,* and especially with that of western forms of the female and their modification at Entebbe, proves beyond doubt that the feature is ancestral in this latter species.

It is worthy of remark that a similar brown margin to the discal white bar of the hind wing is developed in a small proportion of the white (*carmentis*) females of *Acræa jodutta.*

2. *The serrated outer margin of the lower* (*inner marginal*) *half of the fulvous bar crossing the fore wing.* — This feature, which goes far to produce the remarkably close resemblance between the male *macarista* and the female *alciope,* also deserves consideration as a possible instance of diaposematism. Not only are the serrations relatively deeper and more numerous (4 crests and 3 valleys to 3 crests and 2 valleys in the *Planema*) in the *Acræa,* but they are shown by comparison with other forms of the female and with the male, in which however they are far less marked, to be undoubtedly ancestral. On the other hand the feature is found, although not always developed to an equal extent, in the female as well as the male *Planema.*

The serration is produced in a manner common in Butterflies, viz. by the extension of a coloured area outward along the veins, leaving a V-like indentation in each internervular region. It is not so much the serration itself, as its restriction to a corresponding part of the pattern, that constitutes evidence of mimetic approach from one side or from both.

Pseudacræa hobleyi NEAVE, and its forms.

This very interesting series of mimetic forms, on a superficial examination, seems to be opposed to Dr. KARL JORDAN's conclusions on the polymorphism of certain mimetic Pseudacræas, published in the present volume, but, subjected to a more searching enquiry, it tends to support them. It is certainly difficult to believe that a sexually dimorphic form such as *Pseudacræa hobleyi* — its males mimicking two Planemas with a fulvous bar crossing the fore wing, its females mimicking two Planemas with a white bar in a similar position — can belong to the same species as *Ps. terra* NEAVE, in which both sexes mimic the fulvous and black *Planema tellus platyxantha* with a pattern entirely different from the models of *hobleyi*. These latter models, male as well as female, possess the well-known, black-spotted, brown triangle at the base of the hind wing under surface, and so do the two sexes of *Ps. hobleyi*. *Planema tellus*, on the contrary, has the black spots without the triangle, and so has *Ps. terra*.

In spite of these difficulties, the fine series of Pseudacræas provided by the generosity of Dr. C. A. WIGGINS has enabled me to produce evidence in support of the remarkable and unexpected conclusion at which Dr. JORDAN has arrived.

In the first place, the investigation of a long series of specimens shews that the sexual dimorphism of *Ps. hobleyi* is not complete. A female (1) example captured July 18th (Table I) possesses the colour and to a large extent the pattern of the male. It is a mimic of the male and not the female of *Planema macarista*. And this is not an isolated example, for I have since met with others. The whole of the material presented by Dr. WIGGINS will enable me to estimate with a fair degree of accuracy the proportion in which such exceptions occur at Entebbe.

---

(1) I owe the recognition of the sex of this specimen to my friend Mr. HARRY ELTRINGHAM, to whom it had been submitted by my assistant Mr. A. H. HAMM. The shape of the wings is characteristically female, and the form of the anterior or costal section of the V-shaped fulvous bar crossing the fore wing resembles the female pattern rather than the male.

Secondly, intermediate varieties occur between the pattern of the male *Ps. hobleyi* and that of *terra*. Thus, in three males of *hobleyi*, taken respectively on June 13th, June 29th, and August 4th (Table I), the bar of the hind wing is fulvous and not white. The specimen of June 29th is especially remarkable in this respect, the bar of the hind wing being of a tint very nearly as deep as that of the fore wing. The costal end of the hind wing bar is often fulvous in *hobleyi*, although this feature is probably not transitional towards *terra*, but mimetic of a common variety of the male *Pl. macarista*.

A far more remarkable and significant form was captured on August 24th. Although intermediate, it is much nearer to *Ps. terra* than to the male *hobleyi*, and is therefore placed in Table III. On the upper surface, the hind wing is that of *terra*, while the fore wing bears a pattern representing the fusion of the inner marginal fulvous area of *terra* with the V-shaped fulvous bar of the male *hobleyi*. Its colour is the paler tint of *terra* rather than the richer fulvous of the male *hobleyi*. The under surface reproduces the pattern of the upper except for one important feature — the appearance of a reddish tint at the base of the hind wing — clearly transitional towards the reddish brown triangle of *hobleyi*.

A very slight trace of this reddish tinge can generally be detected, especially in the costal region, at the base of the hind wing under side of *Ps. terra* in both sexes.

Furthermore, Dr. WIGGINS' series of captures between May 23rd and August 31st, 1909, not only exhibits transition between *Ps. hobleyi* and *terra*, but also between *terra* and *obscura* NEAVE, the rarest of these mimetic forms of the *hobleyi*-group at Entebbe, and a mimic of the rarest *Planema*-model, *Pl. epæa paragea* GROSE-SMITH. The specimen of *Ps. terra* taken August 14th (Table III) is beautifully transitional towards *obscura* (1). The upper surface colour and pattern of this intermediate specimen bear a close resemblance to those specimens of the *carmentis* female of

(1) About a year later, on September 8th, 1910, an intermediate form between *Ps. terra* and the female *Ps. hobleyi* was taken by Dr. WIGGINS' native collector. The specimen, which has not yet been set, and cannot therefore be thoroughly examined, apparently possesses the white fore wing bar of the female *hobleyi* combined with the hind wing pattern of *terra*.

A. jodutta, in which all the white markings except the subapical bar are replaced by yellowish. An example of this latter form of the female *jodutta* was captured on July 24th (Table II).

Dr. JORDAN's conclusions, based on a study of the male genitalia, are thus supported by a study of the Entebbe material. But inferences so important should be submitted to the ultimate test supplied by the method of breeding before they are accepted as final. However firm the proof, — and Dr. JORDAN'S is certain to be of the firmest, — the cooperation of various lines of evidence is demanded by a conclusion so far-reaching as one which unites into a single interbreeding community, continuous over nearly the whole of the forest areas of Africa, all the divergent forms of the most important mimetic group in the genus *Pseudacræa*, — from *imitator* (1) in the south-east and *rogersi* (2) in the east, through the Uganda forms, *hobleyi, terra*, and *obscura*, to the numerous mimetic modifications of *eurytus* L., on the west coast and the great tropical forest region of the continent.

Pseudacræa kuenowi DEWITZ, subsp. *hypoxantha* JORD.

Dr. JORDAN concludes that this species, which is rare at Entebbe, is entirely distinct from the forms of *Ps. hobleyi*. Its superficial resemblance in both sexes to the far more abundant males of *Ps. hobleyi* is so extraordinarily close as to suggest that there has been a secondary mimetic approach. Such an interpretation is more probable than one based on the hypothesis of arrested divergence; for it is unlikely that details in the shape of the fore wing bar in one sex of a single member of the *hobleyi* group are specially ancestral, and it is these very details that are so precisely reproduced in both sexes of *kuenowi* I may add that the bar of the male *hobleyi* is extremely variable in shape, and that it is the commonest and most characteristic form which appears in the less variable *kuenowi*.

---

(1) *Pseudacræa imitator* TRIMEN.

(2) *Ps. rogersi* TRIMEN.

Pseudacræa albostriata LATHY.
(In Dr. JORDAN's opinion *albostriata* is the Uganda subspecies of *dolomena* HEW.)

It is possible that in *albostriata* we meet with a sudden mutation sufficient to provide the foundation for the evolution of mimetic resemblance. Only 3 individuals exhibiting a very rough likeness to the pattern of the male *Planema macarista* were present in the series of 21 captures recorded in Table I. But even in these mimics, rough as they are, it is improbable that we are witnessing the results of a sudden mutation, and hard to resist the conclusion that there has been some moulding by natural selection. The position and form of the white bar crossing the hind wing, the retention of the fulvous tint at its costal extremity and the replacement of this colour by dark fuscous beyond both margins of the bar, form a combination of mimetic features in whose simultaneous and spontaneous origin it is difficult to believe.

Papilio dardanus dardanus BROWN, **female**
f. *planemoides* TRIMEN.

With the exception of *Ps. kuenowi hypoxantha*, this was the rarest mimic in Table I, only 4 specimens being captured between May 23rd and August 31st. The numerical proportion borne by *planemoides* to the other female forms of *dardanus* at Entebbe requires a much longer period of time and larger number of captures for its determination. It may be stated however that the *hippocoon* F. form, mimicking *Amauris niavius* L., is far commoner than any other, indeed probably far more so than all the others together. Although, in my experience, always in small numbers, *cenea* STOLL, and *trophonius* WESTW., occur at Entebbe, together with *niobe* AURIV., the form which enters Combination III.

The fore wing bar of *planemoides* resembles that of *Pl. poggei nelsoni* rather than of the male *macarista*. Its shape is not very like that of *poggei*, but is even less like *macarista*. The fulvous bar of an Entebbe form of *Elymnias phegea* F., which enters Combin-

ation I, resembles that of *planemoides* rather than the primary models. It is possible that some secondary mimetic approach has taken place, a question that can probably be decided by the examination of a sufficient series of this form, together with a comparison between it and the white-barred form of *phegea* at Entebbe and on the west coast.

Mimacræa poultoni NEAVE.

H. ELTRINGHAM has remarked on the great variability of this species, of which the commonest form is doubtless, as NEAVE originally suggested, a beautiful mimic of *Acræa sotikensis* E. M SHARPE. Some of the forms of this Lycænid at Entebbe perhaps gain advantage as outlying members of Combination I; for their upper surface pattern is such that, upon the wing, there would probably be considerable resemblance to the members of this association, especially to the female of *A. alciope*. Only a single specimen of this *Mimacræa* was captured in the period under review, on June 27th, but it is an example of the form referred to above.

Combination II, centred by the females of *Planema macarista* E. M. SHARPE, and *Pl. alcinoe* FELDER (Table II).

Mr. S A. NEAVE (loc. cit., p. 212) described one of these primary models, viz. the female of *Pl. godmani* (1) BUTL. (= *alcinoe*), and its beautiful Nymphaline mimic, *Pseudacræa tirikensis* NEAVE (= *Ps. hobleyi*, female). He also mentions on the same page the white-barred form of *Elymnias phegea* (not taken in the period with which the present paper deals), placing it among the mimics of the Danaine Butterfly *Amauris niavius*. I do not doubt that the

---

(1) The female *Planema* spoken of by Mr. NEAVE was in reality *Pl. macarista*, which had not at the time been separated from *Pl. alcinoe* in the Entebbe district. The same error was repeated by the present writer in « Proc. Ent. Soc. Lond. », 1909, pp. LXIII-LXIV. We owe the correct sexing and determination of the two species in this area to the recent researches of Dr. KARL JORDAN.

black and white females of Planemas and, through them, their Acræine, Nymphaline, Elymniine and Papilionine mimics have been greatly influenced by the black and white species of the African Danaine genus *Amauris*.

The black and fulvous pattern of the male Planemas is almost certainly ancestral, and the appearance in the females of black and white — a pattern unusual in the *Acrœinœ* — has probably been brought about by the influence upon selection of the dominant Danaines, as indeed the present writer suggested in 1897 (« Report Brit. Assoc. Adv. Sci., Toronto Meeting », 1897, pp. 689-691).

In this sense the models of Combination II may be considered as mimics, their mimics as secondary, and the mimics of their mimics as tertiary. But the resemblance of female Planemas to *Amauris niavius* is rough, while that of the mimics to the female Planemas is strong and precise, so that I have preferred to treat the Combination as a separate category with the Planemas for its primary models. And I have no doubt that the white-barred forms of *Elymnias phegea* are somewhat outlying members of this Combination. They even exhibit traces of the *Planema*-like brown triangle at the base of the hind wing under surface. The indication of this characteristic feature cannot be doubted, vague and indistinct as it is, in common with Elymniine mimicry in general (1).

No other mimics belonging to Combination II had been received from Dr. WIGGINS when Mr. NEAVE's paper was written. Coloured figures of nearly all the forms recorded in Table II are given in Mr. ELTRINGHAM's work.

The two primary *Planema* models of Combination II.

The female of *Pl. macarista* was far more abundant than that of *Pl. alcinoe,* the numbers being 39 to 11. The patterns of the two models are remarkably alike and, upon the wing or in the resting position at a little distance, would be indistinguishable. Without further enquiry it is impossible to decide whether either species has

(1) An excellent account of the « sketchy » mimicry, that is characteristic of the *Elymniinœ*, Oriental as well as African, is given by H. ELTRINGHAM (« Mimicry in African Butterflies », p. 50).

acted as a model for the other. The pattern which they bear in common is characteristic of the females of a group of western Planemas, and we may here be witnessing an example of arrested divergence among the descendants of a common ancestor, which arose under the influence of the black and white Danaines. The possible incipient mimicry of the models of Combination I by the male of *Pl. alcinoe* has been spoken of on page 493.

The mimetic females of *Acræa jodutta* F.

Three different female forms of this species — all mimetic — were captured at Entebbe during the period under consideration in the present memoir : 47 white-marked mimics (the *carmentis*-form) of the females of *Planema macarista* and *Pl. alcinoe* (Combination II), 23 fulvous-marked mimics of *Planema tellus platyxantha* (Combination III), and 4 fulvous-and-white-marked mimics of *Danaida chrysippus* L. These latter combine the *tellus*-like pattern with the white subapical bar of *carmentis*. Their comparative rarity is probably due to the fact that *D. chrysippus* is not nearly so common as the Planemas in the forests where these collections were made and where *A. jodutta* abounds.

Assuming, from its close resemblance to the pattern of the non-mimetic male, that the white-marked *carmentis* is the older of the two principal female forms, it is a tempting hypothesis to suppose that the *tellus*-like female has been produced from it by a sudden colour « mutation », in which the white has been replaced by fulvous. But the patterns are by no means identical, and the differences are such as to increase the likeness to their respective models. The fulvous area covers far more of the hind wing (extending further towards the base as well as towards the margin) of one form than the white does of the other, while the area due to the invasion of the fore wing by the fulvous of the hind is also larger, and of a different shape from that produced in the other form by the invasion of the white. It is unreasonable to suppose that these features, nicely adjusted as they are to the pattern of a species in another genus, sprang into existence, ready-made and complete, and at the same time as the change in colour.

I have recently been given the opportunity of comparing, on a fairly complete scale, the pattern of the white-marked *carmentis*-form

of female in the Lagos district with those of Entebbe. In the absence of *Planema tellus* the fulvous form of female is relatively rare near Lagos and, when it occurs, presents a somewhat different pattern, probably following the male of *Planema epæa* CRAM. as a model. My experience of this latter form of the female *A. jodutta* on the west coast is however insufficient to justify a safe conclusion. The white-marked females of the west differ from those of Entebbe in the greater extension of the white patch caused by the invasion of the fore wing by the pattern of the hind. I have observed this feature not only in many specimens captured in the Lagos district, but also in 16 females of a family recently bred by my friend Dr. W. A. LAMBORN. These shewed no appreciable individual difference in the extent of the white patch in question. This extension of part of the pattern in the west corresponds with the same marking in the western model, the female *Planema epæa*. The two white-marked female Planemas at Entebbe are, on the other hand, without this invasion, or, at the most, exhibit (in *Pl. alcinoe*) but a faint trace of it. They are followed at a distance by the *carmentis* female of the Entebbe *jodutta* with its reduced fore wing patch. Reduced as this patch is, and rendered greyish by overspreading black scales, it still influences not only the white females of *Acræa althoffi* DEWITZ (see p. 504), but also appears to affect the variable female of *Pseudacræa hobleyi*, which in this respect commonly possesses the pattern of the *Acræa* mimic rather than that of the *Planema* model. The slight difference between the western and the Entebbe *carmentis* female of *jodutta*, and its correspondence with the difference between their respective models is also adverse to the mutation theory of the origin of mimicry recently advanced by Prof. PUNNETT, unless indeed a « mutation » may be only another name for a small variation such as the Darwinian has, for half a century, believed to supply the material for mimetic modification.

As regards the base of the hind wing under surface, both white and brown females of *jodutta* commonly possess rather larger spots than the males, thus tending in the direction of their respective models, while the white-marked female also clearly exhibits an early stage in the development of the characteristic brown triangle.

It is interesting to note that one small but important detail in the mimetic resemblance of these two females exists ready-made in

the fore wing of the non-mimetic male, viz. the notch just below the centre of the inner border of the subapical bar. In this respect the brown female is a better mimic than the white, because the corresponding notch is in a similar position in *Planema tellus platyxantha*, whereas in the two white-marked female Planemas it is above rather than below the centre of the bar.

In the *chrysippus*-like forms of the female *A. jodutta* we have merely a combination of the characteristic pattern of the *tellus*-like female with the subapical bar and adjacent white striæ of the *carmentis* female. Natural selection has here been clearly restricted to the combination of existing characters. Among all possible combinations, the one that reproduces the pattern of *Danaida chrysippus* has alone established itself.

Acræa althoffi DEWITZ.

Fifteen males and 11 females of this species were captured between May 23rd and August 31st, 1909. They afford strong evidence of the Müllerian character of the association between the Acræas and the Planemas in two out of the three Combinations. Two of the females are white-marked and mimic the *carmentis* female of *A. jodutta*, itself a mimic of two female Planemas, while one with yellow markings mimics the non-mimetic male of *A. jodutta*. These 3 examples are included in Table II. The 8 remaining females, included in Table III, mimic the fulvous females of *A. jodutta*, themselves mimics of *Planema tellus platyxantha*. While the females of *althoffi* prove that the *jodutta* mimics of Planemas are themselves able to act as models, the peculiarly brilliant upper surface colouring of the male *althoffi* is evidence of the unpalatability that is characteristic of the whole sub-family of *Acræinæ*, so far as it has been experimentally tested.

It is of importance to produce detailed evidence in support of the conclusion that the female forms of *althoffi* are in reality mimics of mimics rather than mimics of primary models.

The upper surface pattern of the white-marked females has been derived from that of the male by the transformation of the red fore wing markings into white, and by a similar modification, accompanied by a broadening and a loss of sharply defined margins, in the yellow bar of the hind wing. The changes described above are

accompanied by a marked diminution in the depth of the black ground-colour, a diminution which renders distinct 3 black spots below the cell of the fore wing. These spots, although distinct on the under surface of the male, are, on its upper surface, barely distinguishable from the dark ground-colour. The general result of all these changes is to produce a pattern which, in its delicate translucency, in the gradual melting of the light markings into the dark ground-colour, especially in the hind wing, and in the invasion of the fore wing by the pattern of the hind, presents a far closer resemblance to the *carmentis* female of *jodutta* than to the females of *Planema macarista* and *Pl. alcinoe*. There is furthermore a close correspondence in size between the females of *althoffi* and *jodutta*. On the under surface the evidence of secondary mimicry is even stronger; for, in addition to the changes described on the upper surface, the brown triangular area at the base of the hind wing of the male is almost lost and the pronounced black spots reduced in number and size. The result is to produce a close resemblance to this element in the pattern of the *carmentis* female. The basal markings of the hind wing under side of the male *A. althoffi* would, if retained in the female, have produced a likeness to the two female Planemas, and the change in the direction of their mimic has involved a departure from the pattern of these primary models.

The single yellow-marked example (August 24th : Table II), which is an evident mimic of the male *A. jodutta*, possesses a pattern similar to that of the two white-marked females, save for the suppression of the linear marking in the cell of the fore wing, a change which renders the mimicry of *jodutta* still more complete. The strong and obvious resemblance of this yellow-marked female to the non-mimetic male of *jodutta* affords further evidence that the white females mimic the females of the same species rather than the primary models of Combination II.

The 8 fulvous females of *A. althoffi* are also better mimics of the *tellus*-like female of *A. jodutta* than of *Planema tellus* itself. The two former agree in the shade of the fulvous markings, which is deeper than that of the *Planema*. In the spotting at the base of the hind wing under surface the female *althoffi* is a good mimic of both *tellus* and *jodutta*, although somewhat better of the latter with its smaller spots, a fact which is all the more significant because of the relatively large size of the spots in the male *althoffi*, to which attention has been already directed.

The production of the fulvous-marked mimetic female of *althoffi* has involved a wider departure from the pattern of the male than that described in the paler mimetic females. The markings in the basal half of the fore wing of the former have not only been changed in tint, but they have also coalesced into a broad fulvous area interrupted only by the three black spots below the cell. A point of special interest is the development of one or two fulvous striæ in the black border at and above the anal angle, representing the less peripherally placed striæ that are very characteristic of the female *jodutta*. In the hind wing also, the departure from the pattern of the male has been greater; for the fulvous area, representing the yellow band, is far more extended than the pale areas of the other females — both white and yellow.

In concluding this account of the mimetic forms of *A. althoffi* I wish to call attention to the resemblance of the under surface of the male to that of the *aurivillii* female of *A. alciope*. There is considerable likeness, in colour as well as in pattern, between the parts exposed in the resting position. If this suggested resemblance be confirmed by observations in the field, the males of *althoffi* should be given a place in Table I, and, being mimics of a mimic, would provide additional evidence that the likeness of the female *alciope* to the Planemas of Combination I is Müllerian. On the upper surface, too, the pattern of the male *althoffi* suggests an outlying association with Combination I, and the white patch on the hind wing of *Acræa admatha leucographa* RIBBE may have become the characteristic of the Uganda form under the influence of the same Combination. There also appears to be a likeness which may be significant between the under surface of the male of *A. althoffi* and that of *A. pelasgius* GROSE-SMITH.

Other members of Combination II.

The beautiful mimetic *Pseudacræa*, the female of *Ps. hobleyi*, has been already considered on page 496. It is here only necessary to speak of its relative abundance, 28 specimens having been taken, as compared with 39 and 11 of the two models respectively. Accepting Dr. JORDAN's conclusions, we find the following

captures of three forms of a single species of *Pseudacræa* at Entebbe between May 23rd and August 31st, 1909 :

Male *hobleyi* form . .	36	*Planema* Models . .	93
Female *hobleyi* form .	28	— — . .	50
Both sexes *terra* form .	18	— — . .	89
Totals. . .	82		232

The mimics were thus well over 1/3 of the models — a remarkably high proportion — and one far more consistent with the Müllerian than the Batesian hypothesis.

In addition to the white-barred *Elymnias phegea*, one or two examples of a Hypsid Moth, *Deilemera acræina* H. DRUCE, which enters this Combination, have been found in Dr. WIGGINS' collections, although not in the period we are now considering.

Combination III centred by *Planema tellus* AURIV., subsp. *platyxantha* JORD. (Table III).

Little need be said about this Combination, of which the members have been incidentally dealt with in the preceding sections. The beautiful mimicry of *Pseudacræ : terra* was described by Mr. S. A. NEAVE (loc. cit., p. 218) and, together with the model and other mimics of the Combination, figured by Mr. H. ELTRINGHAM

The only other members of Combination III present in the collection studied by Mr. NEAVE were the forms of *Acræa encedon* L., referred to below, and the fulvous-marked females of *A. jodutta*. The mimicry of the latter is so perfect that, at the time, it was mistaken for its model by Mr. NEAVE as well as other naturalists, including Mr. ROLAND TRIMEN and the present writer.

The numbers of the *Planema*-model of Combination III are noteworthy, being much greater relatively to mimics than in either of the other Combinations.

A single mimic, a form of *Acræa encedon encedon* L., figured by Mr. ELTRINGHAM, has not yet been sufficiently studied to be given a place in Table III. I refer to the examples in which the subapical bar of the fore wing is fulvous instead of white, the

pattern bearing the same relation to the typical *encedon* that the *niobe* female bears to the *trophonius* female of *Papilio dardanus*. Corresponding changes in the *Acræa* and the *Papilio* have converted a mimic of *D. chrysippus* into a mimic of *Planema tellus*.

Apart from the important facts as to the occurrence and relative proportions of models and mimics, the chief result of the present paper appears to me to be the strong support it affords to the Müllerian as opposed to the Batesian theory of mimicry. This is seen in the numbers of the mimetic forms, in the group to which some of them belong, — the *Acræinæ*, — and above all in the existence of secondary mimicry or the mimicry of mimics. The females of *Acræa jodutta* also clearly prove that polymorphism in mimicry does not furnish evidence in favour of a Batesian interpretation; for *jodutta* is certainly a distasteful member (1) of a distasteful group, and is itself mimicked by *Acræa althoffi*. The perfection of the resemblance attained by the Acræine mimics also refutes another conclusion which, like the last, has been held by distinguished naturalists, *viz*. that a precise and detailed likeness is inconsistent with a Müllerian interpretation.

In concluding this paper I wish again to express my warm thanks to my friend Dr. C. A. Wiggins, who has given me the opportunity of working out these most interesting collections and has generously presented them to the Hope Department of the Oxford University Museum, where they will be readily accessible to all naturalists.

(1) *Acræa jodutta* has recently been shown to be distasteful by some hitherto unpublished experiments carried on in the Lagos district of Southern Nigeria by my friend Dr. W. A. Lamborn.

7

MIMICRY IN NORTH AMERICAN BUTTERFLIES: A REPLY.

BY EDWARD B. POULTON, D.SC., M.A. OXON.

CONTENTS.

Certain criticisms of the theories of mimicry and warning colors have recently appeared in the publications of The Academy of Natural Sciences of Philadelphia, and it is, I think, a convenience that the controversy should be continued in the same channel. The occasion also enables me to contribute in, I hope, an appropriate way to the publications of the great and learned society with which I have the honor and pleasure of being specially associated.

In the present paper I propose to deal with the friendly criticisms contained in Dr. Henry Skinner's paper (**32**). It will be most convenient, I think, to consider the author's arguments under separate heads, which I have arranged as far as possible in the same order as that adopted in his memoir.

1. THE ATTACKS OF BIRDS ON BUTTERFLIES AND THE THEORIES OF MIMICRY.

The believers in these theories, both Batesian and Müllerian, will cordially agree with Dr. Skinner as to the paramount importance

of showing "that birds are in the habit of eating butterflies and that some butterflies are poisonous or nauseous to them and others not." (**32**, p. 121.) It must be admitted also that we require vastly more evidence than we at present possess. But evidence is accumulating steadily, and some of the best has been forthcoming in recent years. I may refer especially to Mr. S. A. Neave's observation (**30**) on January 12, 1912, of a Wagtail devouring Lycænid and Pierine butterflies, but rejecting an *Acraea*, in the bed of a forest stream near Entebbe, Uganda.

Dr. Skinner, in a more recent paper (**34**, p. 25) refers to the fact that the Biological Survey of the United States examined fifty thousand bird stomachs and only found butterflies in five of them. Mr. C. F. M. Swynnerton has quite lately thrown much light on this method of investigation (**33**). He is convinced, as the result of recent work at Chirinda, Gazaland, southeast Rhodesia, "that conclusions based on stomach-examination are likely to be fallacious, unless that examination has been so thorough and minute that even such small objects as the scales of Lepidoptera must have been detected if present, even in small numbers, in either stomach *or intestines*, unless a very large series has been so examined for each species, and unless, finally, a note had been made at the time of the shooting of each specimen as to the probable proportions in which insects of various kinds were present at the moment." Mr. Swynnerton's paper was especially intended as a reply to Mr. G. L. Bates (**25**), whose statements are quoted by Dr. Skinner (**32**, p. 122). I have treated this subject very briefly and inadequately because I hope to return to it in a later paper dealing with the attacks made by Mr. W. L. McAtee in a memoir (**28**) written in a very different spirit from that of Dr. Skinner.

2. Haase's Name "Pharmacophagus" and his Hypothesis that Mimicked Butterflies (Models) derive Nauseous Qualities from the Larval Food-plants.

Dr. Skinner, influenced by my use of Haase's term "*Pharmacophagus*," is apparently under the impression that I am a convinced follower of his hypothesis. This is by no means the case. In a review (**14**) of Haase's work (**13**) I expressed the opinion, to which I still adhere, that the hypothesis is probably true—although as yet quite unproved—for some distasteful species, but that it is certainly not true of others. Rothschild and Jordan (**20**, 433–4), following Horsfield (**1**) and Haase (**9**), have shown that the *Papilioninæ* are

divisible into three well-marked sections differing in larval, pupal and imaginal characters. They give descriptive titles to each of the sections, but do not suggest names which can be used at any rate provisionally as genera. In the meantime, it is highly inconvenient to include in the genus *Papilio* the species of all three groups. For this reason, and for this reason alone, I provisionally adopted Haase's *Pharmacophagus* for the "Aristolochia swallowtails," his *Papilio* for the "Fluted swallowtails," and his *Cosmodesmus* for the "Kite swallowtails."

I am quite ready to abandon any or all of these when it is proved that the three groups may be referred to by other names with a prior claim, and, under any circumstances, Haase's terms cannot, with their present meaning, permanently stand for genera, because, as I learn from Dr. Jordan, each of the three sections is a much larger group which must itself be split up into genera. Furthermore, I do not, as Dr. Skinner states on p. 124, accept any conclusions or use any argument based on the meaning of the word when I provisionally employ "*Pharmacophagus*" as the name of a genus of the Papilios, and I do not think that any words of mine can be quoted which will bear out Dr. Skinner's interpretation.

Inasmuch as Haase's hypothesis occupies so large a place in Dr. Skinner's memoir, I venture to offer a few remarks upon the idea itself as well as upon some of the author's criticisms.

The great majority of the pigments possessed by plant-eating insects are built up in the laboratory of the living organism, in spite of the fact that the larval food is rich in chlorophyll. Nevertheless, this color exists ready-made, and certain insects have been specially adapted to avail themselves of it and thus to gain certain pigments. I proved this many years ago by spectroscopic examination as well as in other ways (**3**, **4**), including experiments in which larvæ were fed upon parts of leaves devoid of chlorophyll (**10**)—experiments recently repeated with confirmatory results upon different species by Prof. W. Garstang (**24**). I think it probable that nauseous or poisonous substances, when they exist in a plant or in a group of allied plants, may be employed by certain species which are restricted to it or them; but as yet the proof is wanting. Among the most probable instances, and those which should first be tested by chemical means, are the *Danainæ* feeding on the Asclepiads and the "*Pharmacophagus*" swallowtails feeding on *Aristolochia* and its allies. I may here remark that Dr. Skinner is mistaken in supposing that Haase in his hypothesis drew any distinction between the *Danainæ* and the

section of the Papilios to which he gave the name *Pharmacophagus*. He maintained that both of them, and the *Ithomiinæ* and *Acræinæ* as well, derived their distasteful qualities direct from the larval food-plants. I refer to the following passage in which Dr. Skinner is speaking of *Danaida plexippus* (**32**, p. 126):

"The protective idea in this case is the same as in the so-called pharmacophagus butterfly, the imago of *plexippus* which is said to be repugnant to birds but the repugance is not based on the idea of the butterfly feeding on a poisonous plant (*Asclepias*) in the larval stage."

As regards the specially protected and much-mimicked group of the *Acræinæ*, the recent hitherto unpublished researches of my friend Mr. W. A. Lamborn upon their larvæ in the Lagos district strongly suggest that the butterflies do not derive the nauseous qualities, which they undoubtedly possess, in the manner assumed by Haase; for the food-plants belong to varied groups. In a letter written July 16, 1913, and received as I am preparing this paper, Mr. Lamborn states: "By far the most common *Acræa* here [the neighborhood of Ibadan, S. Nigeria, W. Africa] is *terpsichore*. Its larvæ abound, and seem, like so many other distasteful caterpillars, to have a wide range of food-plants."

The facts brought forward by Dr. Skinner do not appear to me to affect the probability of Haase's hypothesis. It is well known that insects feeding on a great variety of plants commonly include among these species with poisonous qualities. Haase's hypothesis only refers to certain insects *confined to* poisonous or acrid food-plants. I say "certain" insects, for the power of utilizing the poisonous quality, if it exist at all, is undoubtedly a special adaptation by no means necessarily present in any larva which feeds on the plant possessing the quality. The other fact alluded to by the author, that the acrid principle may be present in very small quantity, is, I think, equally devoid of bearing on the hypothesis. If the adaptation exist at all, we should expect small quantities to be stored up and concentrated. The percentage of lime in a leaf is very small, yet the larva of *Clisiocampa neustria* reserves enough to render its cocoon opaque with minute crystals of the carbonate in the form of aragonite (**5**) and *Eriogaster lanestris* enough to make its eggshell-like cocoon out of the oxalate (**8**).

Haase's hypothesis cannot be proved or disproved by discussion. It is the work of the chemist that is needed. The most appropriate field in the world for this work is North America with its hundreds

of skilled chemists and its well-equipped laboratories, and with two abundant species—*Danaida* (*Anosia*) *plexippus* feeding on Asclepiads and *Pharmacophagus* (*Papilio*) *philenor* feeding on Aristolochias—by which to test the validity of Haase's hypothesis.

3. Indirect Evidence that Pharmacophagus philenor is a Model possessing Distasteful Qualities.

I have myself only seen this insect alive on one or two occasions, and have certainly never had the opportunity of observing it in relation to its natural enemies, nor do I know of any such observations. Scudder states (**6**, 1248–9) that the larvæ are gregarious when young and semigregarious in later life, that the perfect insect is very tenacious of life, and he quotes Edwards for the observation that it has a strong and disagreeable scent. These qualities, especially the two latter, are generally characteristic of distasteful species; but Skinner states (**32**, p. 124) that later specially directed observations have failed to confirm Edwards. Skinner also records (p. 125) the fact that the larvæ are attacked by parasites, but this is commonly true of *Danainæ*, *Acræinæ*, and other distasteful much-mimicked groups. Haase is, so far as I am aware, the only writer on the subject who has supposed that the immunity of models is complete, and probably in all cases protection from insectivorous vertebrates is to a large extent balanced by exceptional exposure to the attacks of parasites and certain other insect enemies, such as Asilid flies and Hemiptera (**19**).

I quite agree with Skinner (p. 125) that the principal attacks are made during the earlier stages of an insect's life—and think of the elaborate protective adaptations which are common in these stages—yet I do not doubt that the imago is subject to severe persecution from enemies of many kinds. Furthermore, it must be remembered that each imago, the heir of all the other stages, and especially each female, is of far greater value to the species than a single pupa or larva and often hundreds of times as valuable as an ovum.

Although I must admit that there is no direct evidence to prove that *P. philenor* is nauseous to birds (p. 123), I believe that much might be learned if American naturalists would offer large numbers of this swallowtail to many species of insectivorous birds in confinement, offering at the same time other butterflies with a procryptic under-surface, such as *Vanessa milberti* or species of *Grapta* (*Eugonia*). The North American Danaine models might be tested at the same time. Although the records of field observations are greatly to be

preferred to this method of experiment, yet in the absence of such observation much may be learned by comparing the behavior of the same individual bird with different species of insects.

The indirect evidence that *Ph. philenor* acts as a model and possesses the qualities of a model seems to me extremely strong. On this hypothesis many facts receive their interpretation; without it they are unexplained and meaningless. *Philenor* is one of the "Aristolochia swallowtails," a section which is abundantly represented in tropical America and in the Oriental Region, but, with the exception of *Ph. antenor* in Madagascar, absent from the Ethiopian Region. The mimicry we observe in North America is not only repeated in both Regions where these swallowtails are abundant, but repeated in a more convincing manner, because the patterns are often far more elaborate, and because an "Aristolochia swallowtail" may break up into numerous geographical races with distinctly different patterns which are mimicked in each locality by corresponding races of the "Fluted swallowtails" and, in the Neotropical Region, of the "Kite swallowtails." A good example is the Oriental *Ph. aristolochiæ* with its subspecies mimicked by the females of *Pap. polytes.* Furthermore, there is in this case experimental evidence that *aristolochiæ* is distasteful, and its slower, more flaunting flight has often been remarked upon. In the Oriental Region species of *Pharmacophagus* are also sometimes mimicked by day-flying moths, and, in the Neotropical Region, not only by these, but by "Kite swallowtails" (*Cosmodesmus*) and Pierines. Throughout the whole range, as in North America, the mimicking "Fluted swallowtails" are as a rule females, while on the other hand the "Kite swallowtails" are mimetic in both sexes (**23**). Just as the other much-mimicked groups—the *Danainæ, Ithomiinæ, Heliconinæ*, and *Acræinæ*—are themselves specially subject to mimicry—the genera or sections of the same subfamily superficially resembling each other and also resembling those of the other subfamilies—so is it in both respects with the South American "Aristolochia swallowtails." In every way these butterflies behave like the great distasteful groups supplying the best known models for mimicry. If we had no experimental or other evidence that the *Danainæ* are unpalatable, the indirect evidence is strong enough to warrant at any rate a provisional acceptance of the hypothesis that they possess some peculiar means of defence which renders them specially advantageous as models. For wherever they are indigenous in the Old World they are mimicked by butterflies of other groups, and even in North America, where

there are only three forms, each one of them is mimicked. It is not as if the models for mimicry were distributed indiscriminately among the butterflies. They are furnished by a few genera here and there among the *Nymphalinæ*, *Pierinæ*, etc., but the vast majority of them are concentrated in the four subfamilies mentioned above and in the "Aristolochia swallowtails." Until these remarkable and very numerous facts are explained by some other hypothesis or until something stronger than negative evidence is forthcoming, we are justified in accepting the hypothesis of advantageous resemblance to a specially defended model. I should be the last to rest content with indirect evidence, however strong, and for many years I have urged naturalists, and especially those in the tropics, to make observations and to undertake experiments. As a result of much work, a considerable body of direct evidence, which cannot be ignored by any fair-minded opponent, has been steadily accumulating, especially from Africa; but I freely admit that more is greatly needed, and I shall continue to urge my friends to seek for it.

4. The Attempt to explain Mimetic Resemblance as due to Affinity between Model and Mimic.

Dr. Skinner appears to adopt the above interpretation of the likeness between the Papilios and *Pharmacophagus* when he says "The three species, *glaucus*, *asterius*, and *troilus*, do bear a resemblance to *philenor* but this happens in any aggregation of species in a genus." (**32**, p. 125.) This interpretation does not bear inspection. In the first place, the butterflies do not in any real sense belong to the same genus, and it is for this very reason that I have provisionally adopted Haase's *Pharmacophagus* for *philenor*. In the second place, the three mimetic species are placed by Rothschild and Jordan in three different groups of the section "*Papilio*" ("Fluted swallowtails"). In the third place, it is clear that the true affinity is shown by the non-mimetic patterns rather than by the mimetic ones—by the upper surface of the male *asterius* and by the males and *glaucus* females of *glaucus*.

Darwin suggested that mimicry began "long ago between forms not widely dissimilar in color," and Scudder adopts the same hypothesis in the following passage:

"The process has been a long one, so that . . . . , we may readily presume far less difference between mocker and mocked when the mimicry between them first began, than now exists between the mocked and the normal relatives of the mocker." (**6**, p. 715). It is

obvious that this interpretation of the resemblances borne by other insects to the stinging Hymenoptera cannot be thus explained, and, within the Lepidoptera themselves, the study of detail has often furnished a refutation. Thus Prof. Gowland Hopkins (**12**, p. 680) writes: "The mimicking Pierid retains the characteristic pigments of its group, while those of the mimicked Heliconid are quite distinct. This would seem wholly to refute the argument that in such cases the likeness may spring from a real affinity between the two insects." (See p. 176.)

5. Sexual Dimorphism (Antigeny of Scudder) and Mimicry.

The mimetic butterflies of North America, as in other parts of the world, are in large part mimetic in the female sex only, forming a special subsection of the far wider group of sexually dimorphic or antigenetic species. Dr. Skinner seeks to explain the special subsection and the inclusive group by an appeal to the same general law. Thus, speaking of the mimetic females of North American Papilios, he says on p. 125: "These differences [between the sexes] occur in numerous species and it seems logical to consider that they are governed by a general law rather than that a few of them are caused by protective resemblance." He uses the same argument concerning the female *Argynnis diana*, which Scudder maintains in the most positive terms to be a mimic of *Limenitis* (*B*) *astyanax*. (**6**, I, pp. 266, 287, 718; III, p. 1802). Comparing this Argynnid with five other sexually dimorphic species of the genus in North America, Skinner says on p. 126: "It does not seem consistent to pick out one species (*diana*) and say that its antigeny is due to tertiary mimicry. How can the dimorphism of the other species be explained?" But the female *diana* is, according to two eminent North American entomologists, Scudder and Edwards, picked out by nature and distinguished among the other antigenetic females by the fact that it resembles a species of a very different Nymphaline genus. I agree with them—although my opinion is worth very little as compared with theirs, for I have never seen the species alive—and I was seeking to place a resemblance which puzzled Scudder, in its true position among the mimetic butterflies of the Region. The far wider question of sexual dimorphism in general did not fall within the scope of my paper. Again, referring to the mimetic female *Papilio*, I do not know why it is specially logical to seek to explain by the same general law two very different categories, viz., the sexually dimorphic females that closely resemble other species and those that bear no

such resemblance. I doubt whether Dr. Skinner would venture to apply the same argument to the polymorphic mimetic females of the Ethiopian *Papilio dardanus* or to many other examples that could be cited. The North American females are not nearly so striking as these, but their patterns are explained by the theories of mimicry and by no other theories as yet suggested.

There are doubtless certain general principles which underlie the whole phenomenon of sexual dimorphism. One of these is obvious—the linking of color, pattern and structure (as we see in the shape of the wings or in the forefeet of so many butterflies) with sex—a linking which is so apt to occur in insects as well as in several other groups, and is so specially conspicuous in the Lepidoptera Rhopalocera. To this principle I think another may be added, at any rate so far as the butterflies are concerned—the greater variability of sex-limited patterns in the female (**23**). But these general principles do not explain the different categories of antigenetic females, although they may, and I think do, explain the fact that there is material out of which these categories have been built by selection. They would also, of course, account for any antigenetic characters, if such there be, that have not been subject to selection. They are the nearest approach to a general law governing antigeny as a whole that can be offered in the present state of our knowledge.

Beyond these principles we have, I submit, to look for special explanations rather than for general laws.

(1) The mimetic females are probably to be explained, as Wallace suggested (**2**, p. 22), by the special needs and special habits of the sex, but also by the fact that the difference in pattern variability may be such that the evolution of mimicry is initiated in one sex and prevented in the other (**23**, p. 132).

(2) A second class of female patterns is procryptic, meeting the special needs of the sex by promoting concealment.

(3) In a third class the whole or a certain proportion of the females of a species retains ancestral patterns (or structures like the fore feet mentioned above) which have been lost or become more degenerate in the males.

(4) Finally the fact that males are so often distinguished from their females by brilliant tints which are pigmentary in some species and structural in others and by scent-producing organs of many kinds strongly suggests an important fourth class due to the operation of sexual selection.

The summary briefly set forth in the last paragraphs will, I think,

show the hopelessness of any attempt to bring all the examples of sexual dimorphism under any single law except one which expresses the two principles explained on p. 169. The complexity of the subject is still further increased by the fact that different elements in the pattern of a species will often fall into more than one class. Thus Dixey has maintained that the female of *Argynnis diana* belongs to the third of the above classes except as regards "the large expanse of blue ground colour," which is mimetic and belongs to the first class (**7**, p. 106, footnote).

In his later paper (**34**) Dr. Skinner has still further developed his objections to any special interpretation of the various classes of sexual dimorphism in butterflies. He speaks of velvety patches on the fore wings of male *Satyrinæ* and brands on the wings of male *Hesperidæ.* The researches of Fritz Müller (**29**) show that these structures are scent-producing organs, and there is no doubt that they are of use in courtship, or epigamic. The law that would be so comprehensive as to explain at once an epigamic scent-patch, the more rudimentary anterior foot of a male Nymphalid and the mimetic pattern of its female, would be so very general that it would not carry us any distance in the attempt to understand each of these different facts.

Concerning *Papilio glaucus glaucus* and its dark *turnus* female (I adopt Rothschild and Jordan's synonymy, **20**, p. 582), which some naturalists at least regard as mimetic of *Ph. philenor,* Skinner says (**34**, p. 25) in criticism of Edwards: "There is also an assumption to which I take exception. Does anyone know which one [the dark or the male-like female] appeared first and why?" With regard to the last word "why," Edwards had expressly disclaimed knowledge, for he speaks of "some unknown influence" causing the appearance of the black female, and we can say no more than this to-day. With regard to the other part of the question, I think it may be shown that Edwards took the reasonable view in supposing that the dark female appeared later than the male-like one. The male pattern is shown to be ancestral, because it bears an intimate relationship to the pattern of other allied Papilios.

This is the argument used by Scudder (**6**, p. 534) in the following passage: "In *Jasoniades glaucus,* where we sometimes have a black female, it is more difficult to decide what should be considered the normal color, owing to diversity of view upon the relationship of many of the swallowtails; but, to judge only from those agreed by all to be most nearly allied to it, there can be no question whatever that the striped character prevails."

The *turnus* female is a partially melanic variety, but the lines of the male pattern can be detected beneath the overspreading pigment. It also exhibits many features in its pattern which have received no interpretation except that they are mimetic of *philenor* or secondarily mimetic of the other Papilionine mimics of *philenor* (**21**, 467–471). No doubt there are examples in which it is probable that melanic females preserve something of an ancestral pattern, as in *Argynnis diana* or the *valesina* form of our British *A. paphia* (**7**, 103–5, 119–21), but I do not think that anyone has maintained that this is true of the melanic females of Papilios. It is, I submit, unreasonable to suppose that the male-like pattern first appeared almost hidden under the melanism of the *turnus* female, and that the full pattern became evident by the clearing up of the dark pigment; whereas the opposite view, that the partial melanism appeared later, obscuring but not completely hiding a pre-existing male-like pattern, seems to me entirely probable. Such partial melanism, in my opinion, provided the foundation on which the details of the mimetic resemblance were gradually built.

As regard this same species, Dr. Skinner's final conclusions (**34**, p. 26) are comprised in the following statement: "The evidence in favor of *glaucus* being brought about by mimicry is almost nil, while the evidence against it is very considerable. The species swarms in countless thousands in the north where *glaucus* does not exist." When we add to these last words the fact that the model *P. philenor* is also non-existent in the north, Dr. Skinner's argument seems to support the view he is attacking. *P. philenor* only enters New England and Southern Canada as a straggler and barely overlaps the range of the northern subspecies of *P. glaucus glaucus*, which Rothschild and Jordan distinguish under the name of *P. glaucus canadensis* (**20**, p. 586). As regards the closely allied *P. rutulus*, the same great authorities give reasons for considering it a distinct species. The whole range of *glaucus glaucus*—Florida to New England and westward to the Mississippi basin—lies within that of *P. philenor*, and over this whole range the dark *turnus* female occurs intermingled with male-like females—the latter preponderating in the north, the former in the south. The evidence based on geographical distribution seems to me strongly to support Edwards' conclusions. And we may add that there are, as I have already said, details in the pattern of the dark females which are not explained by any other hypothesis. Objections based on the great abundance of the non-mimetic ancestor are considered on pages 178, 179.

6. The Female of Neophasia terlooti, another North American Mimic of Danaida plexippus.

Dr. Skinner remarks (**34**, p. 27): "What is the cause of the extraordinary antigeny seen in *Neophasia terlooti?* The male in this species is white and the female orange. The female of the species was once sent to me as a 'little *Danais*' and it really looks like one. Here would be a good opportunity to build up a mimicry theory."[1] At the time when I read these words I had never seen the species, but Dr. Skinner has now very kindly sent me a male and female from Reef, Arizona (Nov. 2, 1903: Biederman). There can be no doubt that the female *is* a mimic of *D. plexippus.* The comparison between the yellow of the under surface exposed in the position of rest and the orange of the upper surface, the blackening of the veins on the upper surface of the hind wing and other details to be described below are quite inexplicable on any other hypothesis. The mimicry is rather rough and there is no approximation in the shape of the wings. In both respects this female stands in about the same position as the females of the Neotropical *Perrhybris* ("*Mylothris*"). I am greatly indebted to my friend for this opportunity of examining and writing on what is to me an entirely new example of butterfly mimicry in North America—another result of its invasion by the Old World genus *Danaida.* My friend Commander J. J. Walker, who has had an intimate experience of the allied *Neophasia menapia* in Vancouver Island, tells me that during flight the latter is one of the feeblest of Pierines and that it suddenly appears upon the wing in immense numbers. He has kindly permitted me to make use of the following unpublished extracts from his journal, on H. M. S. "Kingfisher" at Esquimalt, Vancouver Island:

1882, August 7: "Day still, hot, and cloudless. During the forenoon I was agreeably surprised by the appearance of a good number of specimens of a very pretty "White" butterfly. . . . It seems to come very near to *Leucophasia*, by the elongate shape and delicate texture of its wings, as well as by the rather short antennæ and hairy palpi. . . . They were flying sluggishly in the sunshine over the water, and the signalman and I caught 15 on the poop in a very short time [the ship being about 300 yards off shore]. . . . Landed at 4 P. M.; the *Leucophasia*? was still on the wing, and I

[1] Dr. F. A. Dixey remarked of *N. terlooti* in 1905 (*Proceedings of the Entomological Society of London,* p. xx) : "This latter butterfly is especially interesting as possessing a female which closely resembles some of the mimetic forms of *Euterpe*."

caught 15 or 16 (at flowers of *Matricaria*), all in the most exquisite condition, like those taken on board ship. They all appeared to have emerged from the pupa on that day, as I had been on the lookout for some days past, and certainly did not see one on the wing yesterday."

August 8: "Went on shore this forenoon at 11.30, to get a few more of the *Leucophasia* [*Neophasia*] while it remained in good condition. . . . . I had no difficulty in getting as many as I wanted . . . . a day, however, had made a perceptible difference in its condition, as a good many were getting somewhat worn and chipped. They were very easy to catch, flitting from flower to flower in the open places [among the pines] and of very weak and sluggish flight."

August 14: The first ♀ was taken on this date. "I beat it out of a fir-tree."

The fact that the only Pierine mimic in the Nearctic Region belongs to a genus with the characteristics described by J. J. Walker suggests an interpretation on the lines of Fritz Müller's hypothesis.

I now propose to institute a detailed comparison between the colored pigments of *Neophasia menapia* and *terlooti*.

THE FEMALE OF NEOPHASIA MENAPIA.—*Under surface of hind wing.*—A colored spot, roughly triangular in shape, is found in the black marginal band of areas 2, 3, 4, 5, and 6. The spots, as well as the other markings described below, were orange in 4 females, orange-red in 2, and a rather pale vermilion in one. The tint in some individuals tends to deepen towards the base of the wing—especially along the costa. Beyond vein 7, viz., in areas 7 and 8, the pigment is continued at first as a narrow marginal line, which filling area 8 except at its very base, broadens with it toward the base of the wing. In the opposite direction, beyond vein 2, area 1c bears two spots, of which the upper is sometimes roughly diamond-shaped. These spots are placed one on each side of the dark line, representing a lost vein, which divides the area longitudinally into two sections. Below vein 1b a narrow marginal orange line extends over about $\frac{1}{3}$ of the breadth of area 1b.

In addition to these marginal orange markings, there is also an internervular development of the same pigment starting from the base of the wing, especially distinct in the lower or inner marginal section of area 1c, which in favorable examples is highly colored over more than half its length starting from the base. In strongly marked females a few scattered orange scales are also seen in area 7 and in the upper section of area 1c, and they could probably be found in other areas of certain individuals.

Upper surface of hind wing. Most of the above-described marginal features appear, but far more faintly, on the upper surface. The other orange marks are not represented on the upper surface of those females that I have examined, nor did they appear anywhere upon either surface of the fore wing.

The Male of Neophasia menapia.—*Under surface of hind wing.*—Sixteen examples were examined and of these about half had a comparatively few dull orange or sometimes yellow scales in one or more of areas 6, 7, and 8. When present they are precisely in the position of the marginal markings of the female.

Since writing the above I have had the opportunity of examining 6 beautiful specimens from Esquimalt, in Commander J. J. Walker's collection. Well-developed marginal markings appeared on all females: on (1) a beautiful cinnabar red; on (2) a pale cinnabar red, a little deepened at the anal angle, apex, and costa; on (3) orange, becoming orange-red in the same positions. Of the 3 males, two possessed pale cinnabar scales at the apex and along the costa, one of them bearing a few at the margin of the upper section of area 1c and still fewer—only 2 or 3 scales—in the lower section. The third male had pale yellow marginal scales at the apex and costa, a few becoming faintly reddish, especially at the apex.

Commander Walker tells me that these butterflies were all "set" immediately after capture, and that they have never been "relaxed" and "reset." Inasmuch as Prof. Gowland Hopkins has shown (**11**, **12**) that the pigments of *Pierinæ* are soluble in water, it is probable that Walker's specimens more truly represent the colors of the living insect than do any of the others here described, for all of these have been "relaxed" at least once.

The Male of Neophasia terlooti.—*Under surface of hind wing.*—The marginal markings of the female *menapia* are represented on the male of *terlooti*, smaller indeed, but with a far richer color, being of a bright, rich vermilion tint. In the single specimen I have had the opportunity of examining these markings are solely marginal. They are wanting from area 4 and so slightly developed in all areas except 6, 7, and 8 (where they are purely linear and do not fill the last-named area as in the ♀ *menapia*) that it would be easy to count the constituent scales with a lens. In the specimen before me there are only 3 vermilion scales in area 5 on the left side and only 5 on the right, but they are more numerous and usually far more numerous in all the other markings. Although the dark pigment is comparatively weakly developed in the male, area 1c is divided very

distinctly by a strongly marked linear streak, and the 2 orange spots of the female *menapia* are represented by 2 marginal groups of vermilion scales, one in each section of the area. Vermilion scales occur nowhere else on the specimen, although those described above can be distinctly seen through the translucent scales of the upper surface.

THE FEMALE OF NEOPHASIA TERLOOTI.—*Under surface of hind wing.*—The vermilion markings are developed almost precisely in the positions of the orange markings of the female *menapia*—more strongly at the margin and the extreme base of the wing, but much less so elsewhere. The lower section of area 1c is, however, richly marked with vermilion for ½ of its length from the base. The rest of the colored markings are light yellow of an ochreish tint, rather distinctly different from that seen elsewhere on the wings.

Under surface of fore wing.—The marginal markings and the marginal part of the chief orange patch are also light yellow, but of a lemon tinge. The orange of the chief marking and of scattered scales forming a linear mark in the cell is very rich and deep in tint: the mark in the cell is in fact better described as orange-red. The two marks at the end of the cell, in areas 5 and 6, are transitional in tint between the yellow marginal and the more central orange markings, and there is transition to be observed between the yellow margin in areas 1a and 1b and the rest of the chief orange marking. These changes in color are effected by a gradual increase in the number of orange scales and not by any real transition between the yellow and orange pigments, although if we study the wings as a whole we find several tints of orange and yellow.

Upper surface of hind wing.—The vermilion markings are represented by comparatively few scales. Within these markings the submarginal spots and the ground-color of the rest of the wing are deep orange, but of a duller tint than that of the fore wing. The submarginal spots of the outer (hind) margin are slightly less deep in tint, while along the costa, where the surface is concealed beneath the fore wing, the orange scales are gradually replaced by yellow, and again, at the extreme margin, by black, with perhaps a trace of the vermilion which is so distinct on the opposite surface. The vermilion scales could not be properly investigated because of the overlap of the wings.

Upper surface of the fore wing.—The colors are nearly as on the under surface, but, except at the apex, the submarginal spots and the margin of the principal marking are distinctly less pale and

therefore much nearer to the tint of the orange ground-color of the rest of the wing. The transition here does not appear to be effected by a gradually increasing number of deep orange scales, but by a gradual increase in the depth of the tint. The two marks at the end of the cell are nearly as rich an orange as in the expanse below the cell, and the transition towards yellow is, on the upper surface as compared with the lower, shifted towards the costal margin, occurring in the two spots of the same series placed *above* the end of the cell in areas 10 and 11. The linear spot in area 11 is yellow with thinly scattered orange scales, which are far more thickly placed on the spot in area 10.

7. The Colored Pigments of the Pierinæ as Illustrated by Neophasia.

Professor F. Gowland Hopkins has shown (**11**, **12**) that the white pigment of Pierines is an impure uric acid, and that the yellow orange and probably the red pigments are a derivative of uric acid which he calls "lepidotic acid." No pigments of similar constitution were found in any other butterflies. Therefore, when a Pierine mimics an Ithomiine or, as in *N. terlooti*, a Danaine, the resemblance is effected by the production of an entirely different coloring matter. Gowland Hopkins believes that the yellow, orange, and red Pierine pigments are chemically nearly allied and may pass one into the other by slight changes perhaps in the degree of oxidation. He observed that one tint was represented by another in corresponding markings of opposite sexes or allied species. Thus he remarks (**12**, p. 678):

"It is interesting to note, by comparing various allied species of *Delias*, that the red marginal spot may become more yellow, while the yellow area usually found at the root of the wing may become more red, till both may exhibit a uniform orange colour, or the change may go farther and red and yellow change places without the general color-plan of the wing being altered."

These conclusions are strongly supported by a careful study of *Neophasia*, where it has been shown that in different individuals of the same sex of *menapia* the same markings may be either orange, orange-red, or pale vermilion, while in the opposite sex they may be absent or feebly represented in dull orange or yellow. Again in the allied *terlooti* the corresponding markings are a rich deep vermilion in both sexes. We are led to realize that it is very easy for *Neophasia* to produce any shade between a pale lemon-yellow and a rich vermilion. The colored markings of *menapia* cannot be regarded as

mimetic, and, if *Danaida plexippus* had never entered America, it is highly improbable that anything more than the corresponding colored markings would have been evolved on the wings of the female *terlooti.* The range of tints in the markings common to *menapia* and *terlooti* gives an indication of the variational material out of which selection built up the mimetic pattern. The peculiar shade of yellow of the under surface of the hind wing, the rich orange of the central parts of the upper surface, the paler tints of the marginal markings, especially at the apex of the fore wing, the emphasis by black pigment of the veins of the hind wing upper surface, are all elements in producing the result—a somewhat rough but at a distance almost certainly a deceptive mimetic likeness to *D. plexippus.*

The same considerations help us to understand the prevalence of Pierine mimicry in tropical America as compared with other parts of the world—because of the predominant *Ithomiinæ* and *Danainæ* with warning patterns made up of reds, yellows, whites, and blacks. Such patterns are mimicked by the Pierine genera *Dismorphia* (in the broad sense), *Perrhybris* ("*Mylothris*"), *Archonias*, *Hesperocharis*, and we can now add the North American *Neophasia.*

8. The Restriction of Sex-limited Inheritance to the Mimetic Pattern of Neophasia terlooti.

The older colored markings common to the females of *menapia* and *terlooti* are only partially sex-limited, being inherited in a very reduced form by some of the males of the former species and probably by all of the latter. The more modern mimetic pattern of the female *terlooti* is strictly sex-limited. The facts harmonize with the hypothesis that female mimicry is largely due to the great variability of this sex in Lepidoptera and the freedom with which it offers to selection a wide range of sex-limited colors and markings, but that when a pattern has been long established it tends to be transferred to the opposite sex.

The older non-mimetic marginal markings suggest that the transformation of uric into lepidotic acid is especially easy in this part of the hind wing and invite comparison with the number of mimetic Neotropical Pierines in which marginal or submarginal reds have been developed in the same position, viz., on the under surface of the hind wing—a study that would carry me too far from the subject of the present paper.

9. The Evolution of Limenitis (Basilarchia) archippus from an Ancestor with a Pattern like that of L. (B.) arthemis.

The origin of *archippus*, suggested in the title of this section, is due to Scudder (**6**, 277–8, 714). All I have done is to support the published views of this distinguished naturalist by making a careful analysis of the markings of *archippus* and *arthemis*, by this means demonstrating that the details of the mimetic pattern are accounted for on his hypothesis. I am sorry to find that neither Scudder's hypothesis nor the results of my analysis carry any conviction to Dr. Skinner, who uses the following words: "*Arthemis* and *weidemeyeri* [with a very similar pattern] have flourished prosperously in the struggle for existence, and it is difficult to understand why *archippus* should be so specially favored. The statements attempting to prove the evolution of *archippus* from an ancestral form (*arthemis*) seem to me very inconclusive" (**32**, p. 127). Dr. Skinner makes no alternative suggestion as to the origin of the mimetic species. The doctrine of evolution—for it is hardly necessary to discuss the ancient belief which would assume that *archippus* was originally created in its present form—leaves us only two hypotheses. Either *archippus* was evolved from some form of *Limenitis* which has entirely disappeared or from one which is more or less closely represented by a species still in existence. The former alternative abandons the problem as insoluble, and abandoned it must be if there is no sufficient evidence that the ancestor can be reconstructed from any existing form. I agree with Scudder in preferring the counsel of hope to the counsel of despair. *L.* (*B.*) *arthemis* and *weidemeyeri* present us with an ancestral pattern wide-spread in the genus and found not only in North America, but also with little change in the Old World section of the temperate circumpolar zone. *Archippus* is so closely related to *arthemis* that the larval and pupal stages are almost identical, and although the imaginal patterns are so different, Scudder indicated, and I have attempted to trace in detail, the manner in which one pattern may be derived from the other. I really think that if Dr. Skinner, with specimens of *archippus* and *arthemis* before him, will verify the details of the account in my earlier paper (**21**, pp. 456–459), he will find that many minute features on the wings of the mimetic species are interpreted and correlated in a satisfactory manner. And a hypothesis that interprets stands, until replaced by another that interprets better.

With regard to Skinner's inference that inasmuch as *arthemis*

flourishes prosperously, it is unlikely that a mimetic form would arise from it, this is an objection which at once arises when mimicry is studied in the original monograph of its founder, published long before Fritz Müller had thought of his hypothesis. According to Bates, mimicry was a refuge for the destitute, a last means of escape for a hard-pressed and dying species. It was this very conclusion which was Müller's stumbling-block; for the majority of the mimics in southeast Brazil where he lived were clearly successful and abundant species, and the same is true of the majority of mimicking species wherever they are thoroughly known. Nor is there any reason to suppose that these successful forms originally arose from rare and hard-pressed non-mimetic ancestors. Want of space prevents the discussion of more than a single example. I refer to *Tirumala* (*Melinda*) *formosa*, an Oriental invader into the Ethiopian Region (**18**, **31**). This species, abundant east of the Victoria Nyanza, near Nairobi, is there beautifully mimicked by the Ethiopian *Papilio rex*. The invading Danaine has transformed an indigenous species just as in North America. West of the great lake *T. formosa* is represented by an equally flourishing daughter species, *T. mercedonia*, with a pattern darker than its parent and one much further removed from the allied Oriental *Danainæ*. *Papilio rex* west of the lake becomes *P. mimeticus*, as beautiful a mimic of *T. mercedonia* as *rex* is of *formosa*. The two Danaine models are now distinct species, but their Papilionine mimics, connected by intermediates (*P. commixtus*) in the intermediate geographical area northeast of the Victoria Nyanza, are certainly a single interbreeding community. Similarly, in North America *Danaida plexippus* is a very distinct species from *D. berenice* and *D. strigosa*, although these latter may be geographical races of one species. The three forms of *Limenitis* are, on the other hand, all probably mimetic modifications of a single species, although *L. obsoleta* is probably distinct from *archippus* and *floridensis*. To continue the history of the African invading Danaines: Further westward the flourishing and prosperous *T. mercedonia* has given rise to a still darker species, *T. morgeni*, which has altogether lost the appearance of an Oriental *Tirumala* and has become the most perfect mimic of the African Danaine genus *Amauris*.

Here, then, we have a species so dominant that it is mimicked by a butterfly of a different family. It gives rise to another species and the mimic undergoes corresponding changes. Finally, in spite of these evidences of prosperity, it becomes itself a singularly perfect mimic. All these changes are far less abrupt than that from *arthemis*

to *archippus*, and I do not think that any naturalist who recognized the traces of the pattern of *mercedonia* still lingering almost invisible on the surface of *morgeni* or concealed by the overlap of the wings would doubt that the former is the ancestor of the latter and that the model has become itself a mimic.

Finally, it must be remembered that *L. archippus* has a far wider range than *arthemis*, and it is reasonable to suppose that this advantage has been conferred by its mimetic pattern. *Arthemis* is confined to Canada east of the Rockies and to the northeastern States, while *archippus* is "found over very nearly the same area as *Anosia plexippus*" (**6**, 278).

10. The Relation of the Pattern of Limenitis obsoleta (hulsti) to that of archippus, arthemis and weidemeyeri.

When I wrote the paper criticised by Dr. Skinner (**22**), as well as an earlier paper, in some respects more detailed (**21**), I had never been given the opportunity of examining a series of the Arizona and Utah mimic, *Limenitis obsoleta* (*hulsti*), and my brief account was founded on the excellent fig. 5 on plate VII of Dr. W. J. Holland's work (**17**.) In January, 1909, when I had the honor of representing my country at the Darwin centenary in America, my friend Dr. F. A. Lucas, Director of the American Museum, Central Park, New York, showed me a series of *obsoleta* together with its model, *Danaida strigosa*. The specimens were in the Brooklyn Museum, of which Dr. Lucas was then Curator. I saw at once that the form was very variable and that my work required the study and comparison of a long series of individuals. Dr. Lucas very kindly obtained a few specimens of the model and mimic for me and put me in communication with Dr. R. E. Kunzé, of Phœnix, Arizona, who has generously provided me with a fine mass of material. The following account has been drawn up from the study of 24 males and 9 females from Phœnix and 2 males and 1 female from Tucson. Thirty-three specimens bear the precise date of capture, one the month and year, one a month of which the interpretation is uncertain, and one for which the month is not recorded. Omitting these last two, the dates of capture are given in the following table. The three 1896 specimens were captured at Tucson (2,400 feet) in southern Arizona, the remaining 31 at Phœnix (1,100 feet) in the valley of the Salt River, southern Arizona.

Apr. 9, 1896	1 ♀	June 6, 1896	1 ♂
Apr. 10, 1896	1 ♂	Apr. 22, 1897	1 ♂

Apr. 17, 1909	1 ♀	July 30, 1910	1 ♂
Sept. 21, 1909	1 ♂	Oct. 5, 1910	4 ♂[2]
Sept. 30, 1909	1 ♀	Oct. 7, 1910	3 ♂ 1 ♀
Oct. 27, 1909	1 ♂	Apr. 11, 1911	1 ♀
Oct. ......, 1909	1 ♂	Apr. 15, 1911	1 ♂
Mar. 26, 1910	1 ♂ 1 ♀	Apr. 22, 1911	2 ♂
Mar. 27, 1910	1 ♂	Sept. 5, 1911	1 ♀
Mar. 29, 1910	1 ♀	Sept. 11, 1911	1 ♀
Apr. 1, 1910	1 ♂	Sept. 21, 1911	1 ♂
Apr. 4, 1910	1 ♂	Sept. 24, 1911	1 ♂
Apr. 6, 1910	1 ♂	Oct. 4, 1911	1 ♂

The existence of two broods, one emerging between the end of March and the end of April, the other in September and October, are clearly shown. The two specimens in June and July, respectively, were probably representatives of a third brood.

The model, *Danaida strigosa*, appears to be much rarer than its mimic at Phœnix—at any rate, in the localities where Dr. Kunzé collected. From this place I have only received 2 males, captured July 2 and 6, 1912; from Tucson—1 female May 26, 1 male June 7, 1 female June 9, 1 male August 19, all in 1896; from Prescott (5,400 feet), in western Arizona—2 males and 1 female July 15, 1912.

Dr. R. E. Kunzé, of Phœnix, Arizona, who has had a long and intimate experience of the butterfly fauna of the State, kindly informs me that, in the Phœnix (1,100 feet) and Tucson (2,400 feet) districts and between them, *L. obsoleta* is almost exclusively found in the valleys, along the river-bottoms, and by the canals, where its larval food-plant, a willow, grows.[3] It is commoner in the river-bottoms, especially near the streams, than by the canals. *Danaida strigosa* flies with it in these situations and is indeed commoner there than elsewhere, but, unlike the mimic, it is also found in other places. It is impossible to state the relative proportions of Danaine and *Limenitis*, but by the rivers and canals the mimic is the commoner in the ratio of about twelve or fifteen to one. The proportions at Tucson and Phœnix seem to be the same.

Danaida plexippus occurs, but is scarce in the Salt River valley at Phœnix. Dr. Kunzé estimates that it may exist in the ratio of one to fifteen of *D. strigosa*, but in some seasons he does not meet with

[2] The armatures of two of these males were studied by Dr. Eltringham (p. 190).

[3] Dr. Kunzé adds in his letter of August 5, 1913: "I should say that *obsoleta* has here [Phœnix] from 3–4 broods in a season, from April 1st up to November 1st, in a mild autumn, of course. I think the last brood oviposits on cottonwood, our *Populus fremonti* and other species, because its leaves keep green till latter part of December, whereas willow drops leaves earlier."

it at all. At Prescott, Arizona (5,350 feet), 135 miles north of Phœnix, *strigosa* flies in the company of *plexippus* from July to September, the latter being the commoner of the two. *D. strigosa* extends as far south as Galveston, Texas, and may also occur in some parts of Mexico, near the northern boundary. *Limenitis obsoleta* does not occur at Prescott.

The fine series of *L. obsoleta* (*hulsti*) tabulated on p. 180 at once made clear to me that the Arizona form is not, like *floridensis* (*eros*) in Florida, a local race of *L. archippus* transformed by mimicry of the dominant local Danaine, but the bearer of an ancestral pattern which preserves features lost by the two other mimetic races. I therefore desire to correct my former conclusion, founded on the figure of a single specimen, that *obsoleta* is a modified form of *archippus* (**21**, p. 460, **22**, pp. 171–2). At the same time I remarked in the latter paper (p. 172): "I have not yet had the opportunity of ascertaining whether this hypothesis is supported by evidence derived from a careful study of the pattern."

The hind wing.—The most prominent ancestral features of *obsoleta* are the traces of the white discal band derived from an ancestor with a pattern like that of *arthemis* or *weidemeyeri*. In *archippus* and *floridensis* a trace of the white band is found on the under side of the hind wing in some specimens, but so far as my experience goes never on the upper surface. In *obsoleta* some trace of it is always present on both surfaces, but when, as in the majority of specimens, there is a difference in the degree of development, it is stronger upon the under side. It is more strongly developed in the females than the males, and this is the general rule with the ancestral features of the species, as it appears to be in *archippus*, of which a certain proportion of the males in the Albany district, but no females, have entirely lost the black discal stripe from the upper surface of the hind wing (recorded by Mr. John H. Cook, **22**, pp. 211–212). Thus the white stripe, together with its black outer border, is evanescent on the upper surface of the hind wing of 2 female *obsoleta* from Phœnix and small in the female from Tucson, whereas the same feature is evanescent in half the males from Phœnix and but slightly developed in others. The evanescent feature in both males and females is more strongly represented, generally far more strongly, on the under surface. The degree of development of the black band is generally related to that of the white, the two being usually evanescent together or well developed together, but the range of variation is much greater in the white than in the black, corresponding with the entire disappearance

of the former but not of the latter from the upper surface of the allied *archippus*. On the other hand, the development on the under as compared with the upper surface is greater in the black than the white. In both sexes there is a tendency, as in *archippus*, to throw the white spots on the under surface of the hind wing into relief by an inner edging—a darkened shade of the ground-color in areas 2, 3, 4, and 5, still darker and often black in areas 6 and 7. This feature probably represents the black inner border of the white discal band in the non-mimetic ancestor.

When the 32 specimens, omitting the 2 taken in June and July, recorded in the table on p. 180, are arranged according to their two broods—the 15 March and April specimens together and the 17 September and October together—it is seen that there is a small but distinct seasonal difference in the development of the trace of the white discal band of the hind wing and its black outer border. The spring brood is in this respect distinctly the more ancestral, bearing on the average stronger traces of the pattern of *weidemeyeri* and *arthemis*. This is true of the females as well as the males, as may be inferred from the following statement:

Females (spring brood = 4, autumn brood = 5). — The only 2 specimens with evanescent band and border bear the dates Sept. 11, 1911, and Oct. 10, 1910. The most reduced band of the spring brood is seen in the Tucson specimen, April 9, 1896. In all the remaining 4 spring females, the band and, in all but one, the border is distinctly stronger than in either of the 2 remaining autumn females.

Males (spring brood = 10, autumn brood = 13).—It is extremely difficult to classify the degree of development of the band and border —there is a complete and gradual transition. There is, however, a marked difference at both ends of the scale between the two broods. The most evanescent white bands are seen in 6 autumn males. In all these the feature is more reduced than in any spring male. Very small and reduced bands are found in 3 males of each brood. Beyond these there is the most gradual transition to the highest degree of development found in the sex, and among these we find by far the highest in a specimen captured April 22, 1911, while 2 other spring males are rather beyond any of the autumn brood. Considering the black border separately, the difference is even more marked, for this feature is evanescent in 4 of the autumn brood and none of the spring, while the next 4 are equalled and on the whole slightly exceeded by the 4 spring specimens in which the feature is least developed. The black border is more highly developed in 4 of the spring

brood than in any of the autumn. This detailed comparison has been extraordinarily difficult to make, because of the perfect transition and the minute shades of difference. When the attempt was made to express the difference, the specimens grouped themselves into fours in an irritating and unnatural manner. It might perhaps have been wiser to attempt no analysis of so transitional a feature, but to be contented with the statement that a distinct difference exists at both ends of the scale, the band and border of the most strongly marked specimens being decidedly more developed in the spring brood, while the reduction of these features in the least strongly marked specimens was carried distinctly further in the autumn brood. I cannot but think, however, that my attempts at an analytical comparison, whatever faults there may be in the details, are a truer expression of the facts.

An interesting difference between the upper surface of *obsoleta* and that of *archippus* is common to both fore and hind wings, viz., the far more heavily blackened veins gained by the latter in mimicry of *D. plexippus*. *Floridensis* here shows its origin from *archippus*, for it retains the darkening along the veins, although out of place in a mimic of *D. berenice*. No such evidence of having passed through an *archippus* stage is to be seen on the upper surface of *obsoleta*. The veins are heavily blackened on the under surface of the hind wing in all three mimics, in evident likeness to their respective models, although *obsoleta* in this respect is less darkened and a less perfect mimic than the other two.

In certain specimens of *obsoleta* there is to be seen on the hind wing under surface two largish rich brown sharply outlined patches, one in the cell and one near the base of area 7. On the basal side of each patch is a white spot and a white suffusion commonly surrounds the projection of the precostal into area 8. These elements tend to become evanescent together and distinct together, acting like a single feature. Slight traces of these markings can probably be found on every fresh specimen. They were remarkably pronounced in the female taken Sept. 5, 1911 (p. 181). These vestiges, except in one respect, resemble the well-known basal pattern of *arthemis* far more closely than that of *weidemeyeri*. The pale elements are, however, for the most part blue in *arthemis*, but nearly white in *weidemeyeri*, and therefore in this respect nearer to *obsoleta*. *Archippus* has advanced further from the ancestral forms than *obsoleta*, for "the basal red patches have vanished, but the pale blue marks in and on the costal side [area 7] of the base of the cell are retained, and,

lightened in tint, represent the two more conspicuous white spots occupying nearly the same position in *Anosia* [*Danaida*]" (**21**, 456–7). Now that I have had the advantage of studying *obsoleta*, and have re-examined *archippus* in the light of the new experience, I find that a few examples do possess a very faint trace of the reddish patches of *arthemis*. In these vestiges as in so many other features in the pattern we are led to conclude that *obsoleta* represents an older stage in the evolution of *archippus*.

The fore wing.—The inner edge of the angulated black outer border of the white band of *arthemis* and *weidemeyeri* runs from the costa to the inner margin of the wing, near but well within the posterior angle, although it is broadened so far that its outer edge enters this angle; in most specimens of *archippus* it runs to the junction of the middle and posterior third of the outer (hind) margin (**21**, p. 457). Some females, however, approach the condition of *obsoleta*, which is generally far nearer in this respect to the pattern of *arthemis* and *weidemeyeri*. In *obsoleta* the direction of the vestigial black outer border, which, except near the costa, is evanescent on the upper surface, can be easily traced by fixing the attention on the outer ends of the four prominent white spots in areas 3, 4, 5, and 6. With this as guide, the eye is led on to an evanescent white spot nearly always present in area 2, and in certain individuals to the faint continuation of the black line towards the posterior angle. The angle made with the costa is very different from that of *archippus*. The black line is usually far more distinct on the under surface, and here it may be seen in many specimens that the direction changes abruptly in area 1b, becoming parallel with the outer margin and leading to a termination on the inner margin within, and often well within the posterior angle. In well-marked specimens, especially in the females, the black line is seen to lead to the outer end of a white linear mark close to the inner margin in area 1a (see p. 186). Faint vestiges of the former white band can even be made out in 1b on the under surface of a few individuals. There is great variation in the position of the black line in 1b. In most males it unites with and continues as a broadening of the black margin.

The white spots which represent the costal half of the white band of *arthemis* and *weidemeyeri* are far better developed in *obsoleta* than in *archippus*. In the latter the spots are 2 to 4 in number, the last being very small. In *obsoleta* there are always 4 large and distinct spots, especially well developed in the female, while a minute 5th spot, already mentioned as placed in area 2, is nearly always present

and often more strongly marked on the under surface. A trace of it could be made out on the upper surface of all the females and on 17 of the males; from one or both sides of the remaining males it was absent, but it is likely that when these were fresh examination with a lens would have led to the detection of a few white scales. It is clear that the trace of the original discal band is more shortened in *archippus* than in the Arizona form, and that the 4th spot in area 3, or in other individuals the 3rd in area 4, is now in the position of the minute trace of a 5th spot in area 2 of *obsoleta*. Furthermore, the black discal marking retains in *obsoleta* more of its original appearance as an outer edging to the white band than in *archippus*—an appearance still more fully sustained upon the hind wing. In the fore wing of *archippus* it is obviously much developed, especially at the costal end, in mimicry of the model *plexippus*.

The trace, on the costa itself, of the anterior end of the white band of the fore wing, already described as generally to be found in *archippus* (**21**, p. 457), was present in all the females and 19 males of *obsoleta*, but in some of these it was barely visible. This feature is apparently more often wanting altogether from *archippus*, but the two forms have reached nearly the same level, and I think that in both examination with a lens would reveal the presence of some trace of the marking in most or perhaps all fresh specimens.

I have already incidentally mentioned on p. 185 the most interesting ancestral feature in the fore-wing pattern of *obsoleta*, and one entirely wanting from *archippus*, viz., a distinct trace in area 1a of the inner marginal end of a white discal band like that of *arthemis* or *weidemeyeri*. This linear mark was present, varying in the degree of its development, in all the females and 23 males, and traces might probably have been found on all when fresh. The mark is also to be found on the under surface where the fore wing is overlapped by the hind, but for this reason it was only examined in a few specimens; in these it did not stand out on the paler ground-color as conspicuously as on the upper surface. It has been already pointed out on p. 185 that the outer end of the mark coincides with the point on the inner margin indicated by the direction of the vestige of the black outer border in some individuals, viz., a point well within the posterior angle of the fore wing. In a single female (Apr. 17, 1909), unfortunately rather worn, the mark in 1a apparently extends to the black margin at the posterior angle. The same relationship to a mark stopping short of the angle is also indicated, especially in fresh specimens of the female, by a distinctly

paler shade of the ground-color outside the discal black stripe on both surfaces of both wings. The change of shade follows the suggested direction of the black line to the inner margin of the fore wing, although near this border it is not sharply demarcated as on the rest of the wing. Such an abrupt change in the depth of the color is very rarely to be seen on the upper surface of *archippus*. Scudder has looked on the reddish spots of *arthemis*, occupying the very position of this paler shade in *obsoleta*, as the foundation from which the mimetic form arose (**6**, p. 714), and I have followed him (**21**, **22**). If we are right, and the transformation occurred first in this area and only later in the area inside the white discal stripe, it is easy to understand why there should be a difference in the shade of the ground-color for natural selection to seize upon. The Arizona *Danaida strigosa* is also paler on the outer than it is on the inner part of the wings, although the transition is gradual and not sharp as in *obsoleta*. On the under surface of the fore wing *archippus* is, in this very respect, more strikingly ancestral than *obsoleta*, the pattern of the model having been such as to emphasize the feature. *Archippus* is also commonly ancestral as compared with *obsoleta* in the distinct indication by a reddish-brown tint of the red submarginal spots on the under surface of both wings (**21**, p. 456).

The white mark in area 1a of the fore wing has this further interest, that it indicates the point at which the outer edge of the discal band of the hind wing met that of the fore, reconstructing for us a pattern like that of *weidemeyeri* and *arthemis* in which the band of the hind wing is placed much further from the outer margin than it is in the other wing. The evolution of the marginal pattern of both surfaces of both wings of *obsoleta* from a condition like that of *arthemis* appears to have been the same as in *archippus* (**21**, pp. 456–459) and to have reached nearly the same result. The slight differences correspond with those between the respective models and are doubtless due to mimicry.

The two white spots in the fore wing cell on the under side were present in all the males of *obsoleta*. The females showed greater variability, the basal spot being sometimes absent, but generally much larger than in the males. On the upper surface of the same wing the distal spot was large, for this feature, in 6 females, small in 3, minute in 1. In 14 males it was sharp and distinct, though small, and it could be detected in 8 of the others. In the remainder the triangular black mark in which the white spot lies could be made out by looking carefully for it. White scales were probably origin-

ally present on this mark in some of the worn specimens that do not now possess them. This white spot can be far more frequently detected on the upper surface of *obsoleta* and *archippus* than on that of *arthemis* and probably more often than in *weidermeyeri*, although it may attain great relative size in this species (**21**, Pl. XXV, fig. 1). Its frequent appearance in the two mimics points to an origin from an ancestor of the existing North American species that was in this respect nearer in pattern to *L. lorquini*, in which the spot is almost invariably well developed (**21**, 479, 480, Pl. XXV, figs. 6–8). At the same time the redevelopment of an ancestral feature by means of mimicry must not be lost sight of as a probable interpretation. The pattern of *D. strigosa* is such that the spot in the fore-wing cell of *obsoleta* probably adds to the likeness, at any rate during flight. The strong development of the feature in the females—in this species the more ancestral sex—favors the former hypothesis. As regards the traces of the *Limenitis* pattern persisting in the fore-wing cell on the under surface and their transference to the upper surface, *obsoleta* and *archippus* have reached nearly the same stage. The most strongly marked individuals of the former are, however, more ancestral, in that the white spot on the upper surface and the two spots below are larger and more conspicuous than in any examples of *archippus*.

The seasonal differences on the fore wing were not so well marked as on the hind. Furthermore, the relationship was reversed, the autumn brood being more ancestral than the spring. The difference, however, was barely detectable except in one feature where it was very distinct—the minute white spot in the fore-wing cell. This was sharp and distinct in 11 out of 13 autumn males and only 2 out of 10 spring males. It was also on the whole better developed in the autumn females.

Temperature experiments on the pupæ and, if possible, on the ova and larvæ would be well worth trying on this form as well as on *archippus* and *floridensis*. Considering what has been done by Dorfmeister, Weismann, Merrifield, and Standfuss, remembering also that Lamborn has recently brought evidence which suggests, although it does not prove, that vestiges of "tails" can be brought back to the hind wings of the tailless mimetic females of *Papilio dardanus* (**26**), it is quite probable that some increase in the pattern derived from a non-mimetic ancestor might be induced by the shock of heat or cold applied to the pupal or both larval and pupal stages. And the fact that there are certainly some seasonal differences in the

ancestral elements of *L. obsoleta* renders such experiments especially hopeful.

An experiment made by Edwards and quoted by Scudder (**6**, p. 278) is also encouraging. The black band of the hind wing of *archippus* was widened in two butterflies which emerged from pupæ subjected to cold, being in one specimen, a female, nearly three times the normal width.

It is necessary, in conclusion, to point out in a few words some special effects of the Danaine model, *D. strigosa*. Most prominent among these is the peculiar shade of the ground-color of *obsoleta*, so different from that of *archippus* and *floridensis* and so strikingly like that of the model. The triangular shape of the discal spots of the fore wing, especially pronounced in those of areas 3 and 4, has evidently been produced in mimicry of the characteristic-looking triangular and diamond-shaped spots of the model. The direction of the line of these spots in *obsoleta* which has been shown on p. 185 to be more ancestral, viz., more like that of *arthemis* and *weidemeyeri*, than in *archippus*, has doubtless been stereotyped by the model, in which four of the most conspicuous white spots in areas 1b, 2, 3, and 4 are parallel with the outer margin of the fore wing. It is also probable, as suggested in a former paper (**21**, p. 460), that the retention of the white spots representing the discal band on the hind wing upper surface, and it may be added the linear mark in area 1a of the fore wing, has been aided by "a general likeness" [during flight] "to the pale-streaked hind-wings of *strigosa*." Here, too, the relative development of the feature in the female favors a different interpretation; for, as already pointed out (p. 182), the female is slightly the more ancestral and the male the more advanced mimic in this species. The fact that the traces of the black border of the white discal band, which undoubtedly interfere with the mimetic resemblance, on the whole follow the white spots in the degree of development (p. 182) is also in favor of the supposition that the entire marking is an ancestral feature which has not yet been got rid of.

In order to prove that *obsoleta* is, as its pattern strongly suggests, ancestral as compared with *archippus*—that it stands in a position intermediate between the latter form and the non-mimetic species of *Limenitis*—*arthemis* and *weidemeyeri*—it is necessary to seek for another line of evidence.

11. The Male Genital Armature of the North American Forms of Limenitis.

In former years I have felt, with many other naturalists, some suspicion of the conclusions based on a study of the male genitalia of Lepidoptera. The organs are so complex and in parts so thin-walled, so liable to be deformed by twisting and pressure, that it seemed unlikely that they could escape alteration in the processes of manipulation and mounting. Their shapes are such that a slight difference in the angle at which a drawing is made or a photograph taken makes all the difference to the result. I have, however, been converted by my experience of the work of my friends Dr. Karl Jordan and Dr. H. Eltringham. I have seen the latter naturalist preparing and studying the same parts in different individuals again and again until he was able to determine with complete certainty the actual form that is characteristic of the species or race. I therefore asked him if he would kindly help me by preparing and drawing the genitalia of the North American forms of *Limenitis.* In asking this favor, I was, all unconsciously, making ready for a most valuable test of the validity of the method and its results. At the time when Eltringham made his drawings we had no copy of Scudder's great work (**6**) available, but, when they were finished, I borrowed the volumes from the library of the Entomological Society of London. I turned at once to Plate 33, representing the genitalia of the Canadian and eastern North American species of *Limenitis,* and found that the four figures (9, 11, 12, 15), prepared by Edward Burgess for Scudder, might almost have been copied from Eltringham's drawings or the drawings from the figures! Two careful pieces of work carried out independently have led to precisely the same result. It will therefore be admitted that we may safely accept the six figures on the accompanying Plate V as the expression of the true structural relationships in the different species.

Figures 4, 5, and 6 on the right side of Plate V represent the male genital armatures of species also figured by Scudder, save that his *L. astyanax* (fig. 15) represents the eastern race and Eltringham's (fig. 4) that from Arizona. But the form of the genitalia is nearly the same, as may be seen by comparing the figures, allowing of course for the difference in magnification. Eltringham's figures also show with Scudder's the close resemblance between *astyanax* and *arthemis* (fig. 5, Scudder's fig. 9). The two representations of *L. archippus* are almost identical, save that Scudder (figs. 11 and

12) represents the end of the terminal hook as obliquely truncated, Eltringham (fig. 6) as a simple point.

Figures 1, 2, and 3 on the left of the plate represent forms of *Limenitis* from an area outside the limits of Scudder's monograph. The claspers of *L. lorquini* (fig. 1) are seen to differ markedly from those of all the other forms. *Weidemeyeri* (fig. 2), on the other hand, closely resembles *arthemis* and *astyanax*, although it is of a stouter build. The main interest of the series of figures is, however, concentrated in *obsoleta* (fig. 3). Just as the pattern of this species was seen to be intermediate in many details between that of *archippus* on the one hand and *arthemis* and *weidemeyeri* on the other, so is it with the form of its claspers. To make sure that the appearance represented in fig. 3 was not an individual peculiarity, Dr. Eltringham made a second preparation, but with precisely the same results. The comparison between figs. 2 and 3 suggests that the mimetic form arose from an ancestral species with claspers more like those of *weidemeyeri* than *arthemis*. Looking at these figures, some naturalists may be inclined to suppose that *obsoleta* sprang from *weidemeyeri* in the southwest, while *archippus* developed independently from *arthemis* in the east and north. Such a conclusion seems to me improbable. It is unlikely that independent lines of evolution would have led to structures with the essential similarity that is to be recognized between the forms shown in figs. 3 and 6—I refer especially to the hook below and the strong teeth above the end of the organ—and still more improbable that such independent evolution would have led to the resemblances in minute detail that have been shown to exist between the patterns of *obsoleta* and *archippus*.

Remembering that these conclusions are founded on small differences between organs that are themselves very variable, Dr. Eltringham has confirmed his results by making preparations from 3 individuals of *archippus*, 2 of *obsoleta*, 2 of *weidemeyeri*, and 2 of *astyanax arizonensis*. He finds that the fine points or teeth are not only variable in different individuals, but that they vary on the two sides of the same individual. This he has shown by the careful drawings reproduced on Plate V, where this want of symmetry is apparent in nearly all the figures. The second specimen of *weidemeyeri* has rather fewer teeth than the one figured. In a single specimen of *archippus floridensis* (*eros*) the organs were somewhat larger than in *archippus* and the clasper points were a little less acute. In spite of great individual variability and the want of symmetry, the claspers of the individuals shown in Plate V exhibit recognizable characters

common to other individuals of each species examined by Eltringham and, as regards three of them, by Burgess.

Knowing my own want of experience in the comparative study of these male abdominal appendages, I submitted Dr. Eltringham's drawings to my friend Dr. Jordan, who wrote, Aug. 15, 1913: "*Archippus* appears to be a later modification of *obsoleta*, as you say. *Astyanax arizonensis*, *weidemeyeri*, and *arthemis* are also closely related to one another."[4] Dr. Eltringham also agrees that the comparative study of the armatures supports the conclusions arrived at from a study of the patterns.

Considering together pattern and the structure of the claspers, there are strong reasons for believing that the mimetic forms arose from a North American *Limenitis* with the pattern of *arthemis* and *weidemeyeri*, but including a white spot in the fore-wing cell upper side now seen most commonly in *lorquini* among North American species, and with claspers like those of *weidemeyeri* and *arthemis*, but probably nearer to the former.

I trust that Dr. Skinner will consider that this evolutionary history, if not convincing before, has been rendered so by the fresh evidence now produced.

12. Similar Environmental Conditions versus Mimicry as an Interpretation of Color Resemblances.

With regard to the resemblance of *Limenitis* (*Basilarchia*) *floridensis* to *Danaida berenice* in Florida and of *L.* (*B.*) *obsoleta* (*hulsti*) to *D. strigosa* in Arizona, Skinner suggests (**32**, p. 127) that "similar environmental conditions explain these color resemblances better

[4] The remainder of Dr. Karl Jordan's letter contained an interesting and suggestive criticism of Scudder's conclusion that *proserpina* is a hybrid between *arthemis* and *astyanax*.

"The differences in the genitalia between *astyanax* and *arthemis* might render copulation a little difficult, but are too insignificant to prevent it. According to Scudder, *proserpina* is the hybrid between *astyanax* and *arthemis*. If that is the case, the genitalia should be intermediate. As they are identical (teste Scudder) with those of the northern insect, I do not believe that *proserpina* is a hybrid. The offspring of a ♀ *proserpina* were partly *proserpina*, partly *arthemis*. This also points in the direction that *astyanax* has no part in the production of *proserpina*. Scudder appears to rely particularly on *this* point—*proserpina* inclines towards *astyanax* where the latter prevails, and towards *arthemis* in the places where this insect is abundant. But such an agreement in coloration may simply be due to the two occurring side by side. It is not necessarily evidence for hybridization. I have only looked at Scudder's book, not at the specimens; my opinion is therefore worth very little, but I incline to the belief that *arthemis* assumes the pattern of *astyanax* where it comes into contact with the latter, *i.e.*, that *proserpina* is a southern modification of *arthemis*, not a hybrid. It would be advisable, however, to examine the genitalia of a series of specimens of all three insects."

than the hypothesis of mimicry." He does not venture to suggest this interpretation for the resemblance of *L.* (*B.*) *archippus* to *Danaida plexippus;* for the great environmental changes endured by both model and mimic in their extensive north and south range make any such suggestion untenable. With regard to the detailed likeness of three forms of *Limenitis* to three Danaine butterflies in North America, I may fairly retaliate on my friend and point out in his own words, *mutatis mutandis*, that "it seems logical to consider that they are governed by a general law rather than that two of them, but not the third, are caused by similar environmental conditions." I have already many years ago dealt with this supposed interpretation of mimetic resemblance by an appeal to the forces of the environment, and the arguments then brought forward (**15**) have, so far as I am aware, never been met. Dr. Skinner does not attempt to meet them, nor does he even allude to the peculiarly strong evidence furnished by these very North American mimics against the hypothesis of environmental conditions. Although this evidence is clearly set forth in the paper which Dr. Skinner was discussing (**22**), as well as in earlier publications of mine (**16**, **21**), I will repeat the substance of it on the present occasion.

The three Danaines of North America are modern invaders from the Old World, quite isolated and out of place in the New, while the genus *Limenitis* is an ancestral element in the North American fauna. My own experience of insect systematics is very limited, and I could not with any confidence or authority attempt to weigh the value of characters which have been described as generic. Knowing these limitations only too well, I applied to my friend Dr. K. Jordan, and he, after making fresh investigations into the male genitalia and carefully studying Moore's generic characters, came to the conclusion that the Old World *Limnas* and *Salatura* and the New World *Anosia* and *Tasitia* could not be sustained as separate genera, but that all four were to be properly included in the single genus *Danaida*. This genus is nearly related to several much-mimicked groups of *Danainæ* in the Old World, but the two species from which the few American geographical forms have been derived are aliens in the New World.

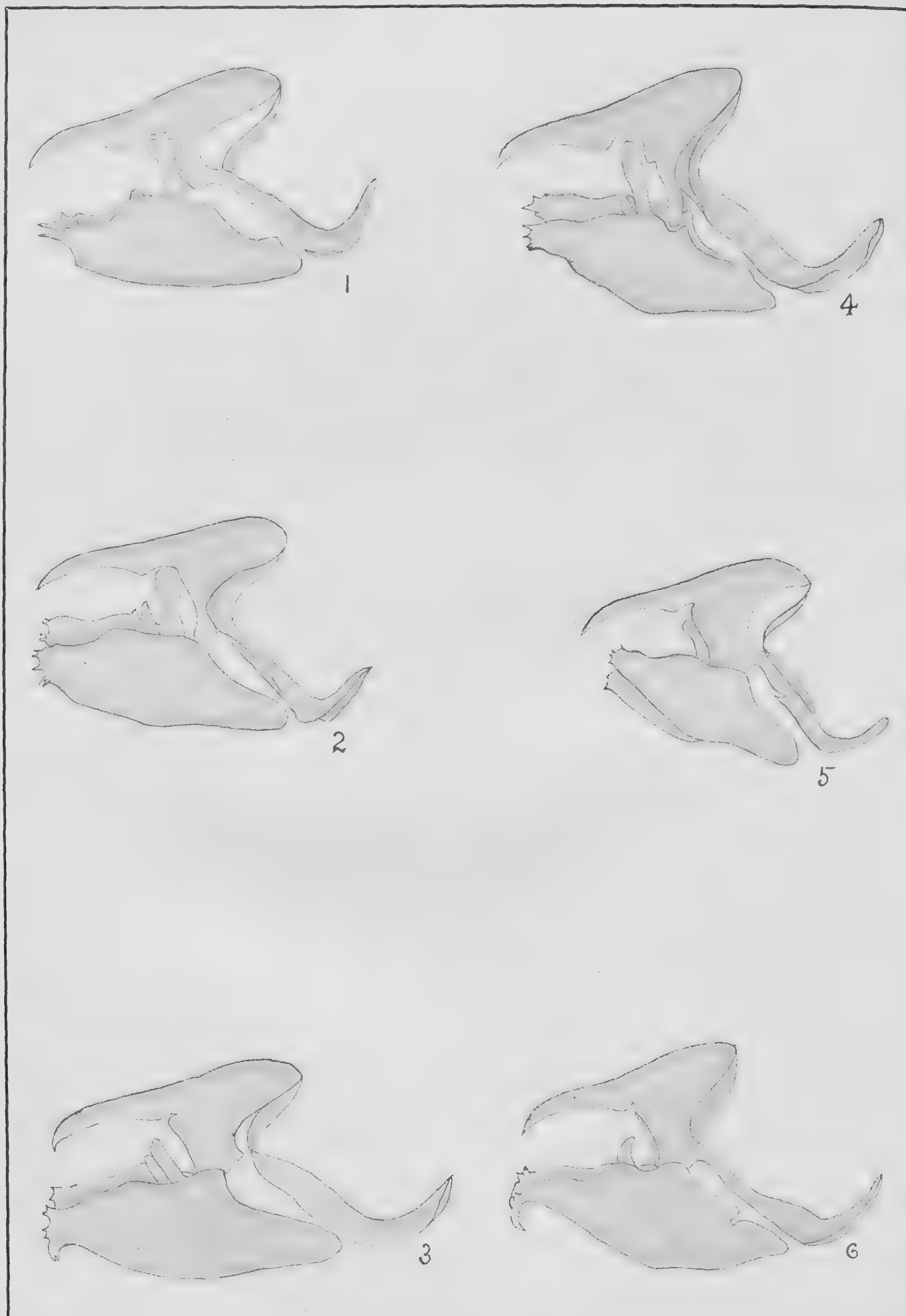
Dr. G. B. Longstaff has recently shown that in the gregarious instinct, as manifested by hanging in festoons and clusters from trees, the Old World *Danaida genutia* (*plexippus*) resembles its New World representative *D. plexippus* (**27**, pp. 75, 76), in which the same habit has often been observed (**6**, pp. 730, 734–7)

Even in pattern there is but little difference between the most nearly allied Asiatic and American species of *Danaida*, and if, as Dr. Skinner believes, color and pattern are the expression of environmental conditions, then they are the expression of an Old World, and not of a New World environment. On Dr. Skinner's view, the Old World invader, when it became exposed to the new environment, should have come to resemble the New World resident. Instead of this, the resident has come to resemble the invader.

In concluding the present paper I may quote an opinion expressed to me by Professor Svante Arrhenius. A few years ago I asked my friend whether he thought it possible to explain by the incidence of physico-chemical forces, such as those of the environment, the superficial resemblance of one form to another when that resemblance required, as in the development of a complex pattern, the co-operation of many different factors. He replied, as I expected, that he did not consider the explanation possible; for the building up of such a likeness was inconceivable except by the aid of selection. This was the argument I advanced in 1898 (**15**), after an analysis which showed that mimetic resemblance often requires the co-operation of many different factors; and it was a great satisfaction to find the conclusion confirmed by an authority with Professor Arrhenius' broad outlook on the sciences in their relation to one another and to mathematics.

Bibliography.

1. Horsfield, T. 1857. In Horsfield and Moore's Catalogue of Lepidopterous Insects, Museum of the East India Company, London.
2. Wallace, Alfred R. 1865. Transactions of the Linnean Society of London, XXV (1866), Pt. I (1865), p. 1.
3. Poulton, Edward B. 1885. Proceedings of the Royal Society of London, XXXVIII, pp. 269–315.
4. —— 1886. Proceedings of the Royal Society of London, XL, pp. 135–173.
5. —— 1889. Proceedings of the Entomological Society of London, pp. xxxvii–xxxix.
6. Scudder, Samuel H. 1889. "Butterflies of the Eastern United States and Canada," Cambridge, Mass.
7. Dixey, F. A. 1890. Transactions of the Entomological Society of London, pp. 89–129.
8. Poulton Edward B. 1891. Proceedings of the Entomological Society of London, pp. xv, xvi.
9. Haase, E. 1893. Untersuchungen über die Mimicry.
10. Poulton, Edward B. 1893. Proceedings of the Royal Society of London, LIV, pp. 417–430.
11. Hopkins, F. Gowland. 1894. Proceedings of the Royal Society of London, LVII, 1894, p. 5.
12. —— 1895. Philosophical Transactions of the Royal Society of London, B., Vol. 186, Pt. II, pp. 661–682.
13. Haase, E. 1896. "Researches on Mimicry," Pt. II, Stuttgart. English translation.



POULTON: MIMICRY IN BUTTERFLIES.

14. POULTON, EDWARD B. 1897. Nature, LVII, pp. 1–4, 25, 26.
15. —— 1898. Journal of the Linnean Society of London, Zoology, XXVI, pp. 558–612. Also published in "Essays on Evolution," Oxford, 1908, pp. 220–270.
16. —— 1902. Verhandlungen of the V. International Zoological Congress, Berlin, pp. 171–179.
17. HOLLAND, WILLIAM J. 1903. "The Butterfly Book," New York.
18. NEAVE, S. A. 1906. Transactions of the Entomological Society of London, pp. 207–222.
19. POULTON, EDWARD B. 1906. Transactions of the Entomological Society of London, pp. 323–409.
20. ROTHSCHILD and JORDAN. 1906. "Novitates Zoologicæ." Tring., XIII, pp. 411–753.
21. POULTON, EDWARD B. 1908. Transactions of the Entomological Society of London, pp. 447–488.
22. —— 1909. Annals of the Entomological Society of America II, pp. 203–242. Also published in "Darwin and the Origin," 1909, pp. 144–212.
23. —— 1909. Mimicry and Sex, in "Darwin and Modern Science," Cambridge, 1909, pp. 292–295. Also published in "Darwin and the Origin," pp. 132–139.
24. GARSTANG, W. 1910. Nature, LXXXIV, pp. 549, 550.
25. BATES, G. L. 1911. Ibis, London, pp. 630, 631.
26. LAMBORN, W. A. 1912. Proceedings of the Entomological Society of London, pp. cxxxi–cxxxiv.
27. LONGSTAFF, G. B. 1912. "Butterfly-hunting in Many Lands," London.
28. MCATEE, W. L. 1912. Proceedings of The Academy of Natural Sciences of Philadelphia, pp. 281–364.
29. MÜLLER, FRITZ. 1912. Collected papers translated by E. A. Elliott in Appendix to "Butterfly-hunting in Many Lands," by G. B. Longstaff, pp. 601–666, plates A, B, C, D, E, F, G, H, J.
30. NEAVE, S. A. 1912. Proceedings of the Entomological Society of London, p. lv.
31. POULTON, EDWARD B. 1912. Proceedings of the Entomological Society of London, pp. xxxi–xxxii.
32. SKINNER, HENRY. 1912. Journal of The Academy of Natural Sciences of Philadelphia, Second Series, XV, pp. 121–127.
33. SWYNNERTON, C. F. M. 1912. Ibis, London, October, pp. 635–640.
34. SKINNER, HENRY. 1913. Entomological News, XXIV, pp. 23-27.

EXPLANATION OF PLATE V.

Genital armatures of male North American *Limenitis* (*Basilarchia*). Figures drawn by H. Eltringham. All the figures are magnified about fourteen diameters.

Fig. 1.—*Limenitis lorquini.*
Fig. 2.—*L. weidemeyeri.*
Fig. 3.—*L. obsoleta.*
Fig. 4.—*L. astyanax arizonensis.*
Fig. 5.—*L. arthemis.*
Fig. 6.—*L. archippus.*

Reprinted from the Bulletin of the Hill Museum, 1922.

NOTE ON THE MIMETIC RESEMBLANCE BETWEEN THE ERYCINID *PRAETAXILA POULTONI* J. AND T., AND THE AGARISTID *IMMETALIA SATURATA LONGIPALPIS* KIRSCH.

By Professor E. B. POULTON, D.Sc., M.A., F.R.S.
Hope Professor of Zoology in the University of Oxford.

When Mr. Talbot brought his interesting exhibit to the Entomological Society on October 19, 1921, I assumed that the moth was the model for the butterfly (*Proc. Ent. Soc., Lond.*, 1921, p. xc). I was, however, concerned with the curious resemblance of male to female and female to male rather than the determination of the species in a Müllerian pair which had acted as the model for the other—a conclusion for which little evidence was then before me.

Now that, owing to the kindness of Mr. Talbot, I am in possession of all the known facts, I can only adhere to the same opinion—that the moth has acted as model. No other interpretation of the mimetic likeness seems possible, in view of the fact that the moth has a very wide range and the butterfly a very restricted one. In that limited area the butterfly resembles patterns which are borne by the moth in various other localities as well.

The specimens of the Agaristid in the collection from Dutch New Guinea, containing nine ♂ ♂ and thirteen ♀ ♀ of the Erycinid, were as follows :—

♂. f. *longipalpis* Kirsch (white bands).

Wanggar, February, one.

♀. f. *longipalpis* Kirsch (orange bands).

Wanggar River, 15 miles from coast, ca. 600 feet, January, two. Nomnagihé, 2,000 feet, January to February, one.

♀. f. *brujni* Ob. (white bands).

Wai Sai River, 1,000 feet, June and July, one. Wanggar River, 15 miles from coast, January, one.

The numbers are, of course, extremely small, and probably no cri-

terion of the abundance of the moth, because, as Mr. Talbot writes, "The collectors made a point of catching what they knew to be a species never seen by them before, and paid little attention to a moth which had been taken on previous expeditions."

On the facts before us we must modify the original statement that the male mimics the female, and the female the male, as follows. The male Erycinid (orange-banded) mimics one form of the female Agaristid, while the female Erycinid (white-banded) mimics the other form of female, as well as the male Agaristid. Thus, as constantly happens in mimicry, the advantage lies with the female, which has a model of its own sex as well as of the other. It must be remembered, however, that a single male of a new race of another Agaristid, *Argyrolepidia aurea* Jord., was present in the same collection, having been taken at Wanggar in February. To this specimen the male Erycinid bore an even closer resemblance than to the orange-banded females of the *Immetalia;* but until we know the female, and more about the relative abundance of the new form, it is impossible to speak confidently of its significance in this association. It is much to be desired that a long series of the two Agaristids and the Erycinid from the same locality may be available for future study.

Looking at the *Erycinidae* as a group, those of tropical America, when they enter into mimetic associations, are generally mimics, often of Ithomiine butterflies, often of moths, as pointed out by Godman and Salvin in their great monograph on the Lepidoptera of the "Biologia Centrali-Americana." I cannot recall an undoubted example of a Neotropical Erycinid acting as a model. On the other hand, among the comparatively scanty *Erycinidae* of the Old World, there is the Chinese *Stiboges nymphidia* Butl. which is almost certainly the model, and not the mimic of the Epiplemid moth, *Psychostrophia nymphidiaria* Ob.

The *Agaristidae* freely act as models, especially in Müllerian mimicry. A good example from Borneo is figured by Shelford in P.Z.S., 1902, vol. ii, pl. xxi, figs. 7, 8, where the mimic is *Eterusia obliquiaria* Walk., belonging to the specially protected *Zygaenidae* (*Chalcosiinae*). In tropical West Africa there is the well-known Nymphaline mimic *Euphaedra eusemoides* S. and K., which is known to fly with its Agaristid models, differing in habits from its nearest relatives, as recorded by Dr. S. A. Neave in *Proc. Ent. Soc. Lond.*, 1908, p. lxxx. Agaristids also enter into Müllerian groups as mimics, a good example being *Xanthospilopteryx poggei* Dew., with the pattern of the much-

mimicked African Geometrid moth *Aletis*, also resembled by a butterfly *Euphaedra ruspina* Westw., and some forms of *E. eleus* Drury.

NOTE BY G. TALBOT.

With the exception of *eromena* Jord., which occurs in the Snow Mountains, no other *Praetaxila* is known which is at all like *poultoni*. In *eromena* the sexes are similar to the sexes of *poultoni*.

The Agaristid *Immetalia saturata* Walk., ranges from Buru and the North Moluccas to New Guinea and New Ireland, whilst *Argyrolepidia* is confined to New Guinea as far as is known.

The *Immetalia* has dimorphic, trimorphic, and tetramorphic forms, sometimes occurring in the same area, and in which the white and orange bands are transposed in the same sex and between the sexes.

For full details of the distribution of the Agaristid, reference should be made to Seitz, Macrolep, xi, *Agaristidae*, by Dr. K. Jordan.

Figures of the *Praetaxila* and the two Agaristids will be published in Part III.

JOHN BALE, SONS AND DANIELSSON. LTD., Printers, 83-91, Great Titchfield Street, London, W. 1.

[*From "The Transactions of the Second Entomological Congress*, 1912.]

PELLETS EJECTED BY INSECT-EATING BIRDS AFTER A MEAL OF BUTTERFLIES.

By C. F. M. SWYNNERTON, CHIRINDA.

PROFESSOR POULTON read a communication by C. F. M. SWYNNERTON, F.E.S., contained in the following letter, written June 27th, 1912, from Chirinda, Gazaland, S.E. Rhodesia. Professor POULTON also exhibited the pellets referred to, together with set examples of the butterflies named.

"I am sending you by this mail a few pellets that have been ejected by birds. Those pellets that are intact—from *Dicrurus afer* Licht. (African Drongo); *Lanarius starki* W. L. Scl. (Southern Grey-headed Bush-shrike); *Lanius collaris* L. (Fiskaal Shrike)—contain no butterfly remains. I merely send them in case you should be interested to see the pellets of Passerine birds. The other pellet from *Dicrurus afer* Licht. (African Drongo), ejected October 12th, 1911, does contain butterfly remains. I have just examined a portion of it in order to get an idea as to what sort of a sample I was sending you, and it does not strike me as being as good as many that I have seen. Even here, however, it seems to me that any one unused to the appearance of butterfly remains in pellets and making an examination, especially a rough one, with the naked eye, might well fail to recognise a considerable portion of the débris. Put it, however, under a lens strong enough to show the scales and sockets, and the difficulty vanishes. This particular pellet should contain the remains of twenty-six butterflies and eight flies.

"The flies were:

One *Tabanus* sp. nov. (my No. 3,689, sent to GUY MARSHALL).

Five *Hæmatopota sanguinaria* Aust. (At first determined as this species by Mr. E. E. AUSTEN, but

later considered by him to be a distinct species still undescribed.)

Two *Cadicera biclausa* Loew (my Nos. 3,683 and 3,684, sent to GUY MARSHALL).

"The fifteen butterflies that were swallowed, wings and all, were:

Seven *Mycalesis campina* Auriv.
Two *Neptis agatha* Stoll.
Three *Pyrameis cardui* L.
One *Precis orithya* L. v. *madagascariensis* Guen. (= *boopis* Trim.).
One *Papilio demodocus* Esp. (hindwings only: head and front of thorax also not swallowed).
One *Rhopalocampta libaon* H. H. Druce.

"The eleven that were eaten without wings were:

One *Precis cebrene* Trim.
Three *Precis octavia* Cram. var. geogr. *natalensis* Staud. dry season f. *sesamus* Trim.
One *Precis tugela* Trim.
Two *Precis artaxia* Hew.
Two *Pyrameis cardui* L.
One *Pseudacræa lucretia* Cram.
One *Charaxes pollux* Cram.

"You have the entire pellet (I lost at the most only a few scales in examining a portion of it), yet I *doubt* whether you could easily find in it evidence of the bird having shortly before eaten all these Lepidoptera and Diptera; yet the pellet represents the whole evidence (unless the intestines were also examined) that a man who shot the bird shortly before it was ejected would have had to go on.

"Small grasshoppers had been eaten just before the experiment, and are also represented in the pellet. I also send another smaller pellet of the same date, containing grasshopper débris. I presumably kept it to compare with the one containing butterflies. I have no note to show whether it came before or after the latter.

"I have practically never troubled to keep the pellets after a butterfly experiment, but might easily do so, should you think

it worth while. Thus an interesting and convincing exhibit might be made of the contents of, say, a dozen pellets, representing a dozen species of birds. In each case Coleopterous remains might be placed in one row, Orthopterous in another, butterfly-remains in another, and so on, and beside each might be placed the complete insects, set, to indicate the relative amount of disguise that had taken place.

"While writing the above it struck me to hunt up a pellet of *Coracias garrulus* L., brought up during an experiment on April 2nd of last year. I see the envelope is undated, but my recollection with regard to it seems pretty clear, apart from the fact that this was, I feel sure, the only pellet belonging to this particular roller ('C') that I have kept. I thought, I remember, that it might be interesting to examine it some day, but am sending it to you intact, as I think that, if the butterfly-remains in it are at all typical of what I have usually seen, you will find it more interesting and convincing to have broken it up yourself. Before doing this (breaking up) I find it best to let the pellet absorb water freely. The small wing fragments are then most easily detected by placing a small fragment of the pellet at a time in a few drops of water; many of them float. The appearance of the wing-veins is often interesting—mere fragments of rods with little or, often, no membrane attached.

"I am also sending you a pellet of *Bucorax caffer*. I have no idea what it should contain, apart from what can be seen on the outside, but as it forms one of a number collected with a view to throwing light on the food of my unconfined ground-hornbills, either its contents or a note of them should be kept. I am sending it because I see that it contains fairly typical remains of Coleoptera, and I think you will like to compare these with those of the butterflies, grasshoppers, and flies contained in the other pellets sent.

"I had nearly forgotten to say that the roller 'C' had eaten, just before bringing up the pellet referred to above, several grasshoppers, one *Melanitis leda* F., two *Hypanartia schæneia* Trim., one *Precis antilope* Feisth., one *Precis artaxia,* one *Charaxes zoolina* Doubl.-Hew., one *Tagiades flesus* F., one *Rhopalocampta forestan* Cram., one *R. libaon* Druce, one *Papilio nireus* L. v.

lycæus Doubl.—ten butterflies in all, each of them swallowed wings and all.

"So far as the 40,000 American birds' stomachs are concerned, *if* they were microscopically and thoroughly examined, then they constitute a very damaging argument. If they weren't, then the results of their examination are valueless in relation to this particular discussion. MARSHALL has re-examined more than one hundred of my bird-stomachs and, I believe, found no additional lepidopterous remains, but I do not know whether he looked for mere scales. I re-examined three during the past week (all I had time for) and found remains of Lepidoptera in two of them (*Erithacus swynnertoni* Sharpe, the Chirinda Robin, and *Merops apiaster* L., the European Bee-eater). In the case of the robin I had carefully examined several fields under my little microscope before I found the first scale, and it was only right at the end that I found several more, as well as several minute wing-fragments, such as I have commonly found in pellets. This shows the need for an absolutely *exhaustive* examination of each stomach.

"You are, of course, welcome to utilise the pellets I send as you wish. Should you find them good as instances of disguise you may care to show them or quote them when writing on the subject."

[*Extracted from the* Linnean Society's Journal—Zoology, vol. xxxii. *September* 1914.]

Results of Crossing *Euschistus variolarius* and *Euschistus servus* with reference to the Inheritance of an Exclusively Male Character.

By Katharine Foot and E. C. Strobell. (Communicated by Prof. E. B. Poulton, F.R.S., Pres.L.S.)

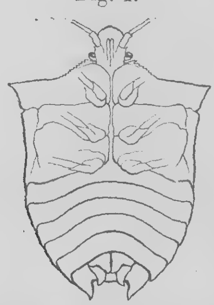
(Plates 28–34, and 2 Text-figures.)

[Read 5th March, 1914.]

Euschistus variolarius has an exclusively male character which is not present in *Euschistus servus*, and it was the hope of being able to study the transmission of this character, and its bearing on modern chromosome theories, that led us to attempt to cross these two species *.

This specific character is a distinct black spot on the male genital segment of *E. variolarius*, and as there is no spot on the genital segment of the female (text-fig. 1), this spot in *E. variolarius* is an exclusively male character.

Fig. 1.



Euschistus variolarius ♀. A comparison of this sketch with the male *variolarius* of photo 1 (Pl. 28.), will show the marked difference in the form of the genital segment of the two sexes, and will demonstrate that the genital spot characteristic of the male could not appear in the female without a modification of the entire genital segment.

The two species (*variolarius* and *servus*) are shown in photo 1 (Pl. 28). On the left is a male *variolarius*, and on the right a male *servus*. The spot on the male genital segment of *variolarius* is clearly demonstrated, and the complete absence of such a spot on the male genital segment of *servus* is clearly shown. This spot in *variolarius* is a constant character: it appears as distinctly in all the males of this species as in the seven specimens shown in photo 2. Five male specimens of *E. servus* are shown in photo 3 (Pl. 30).

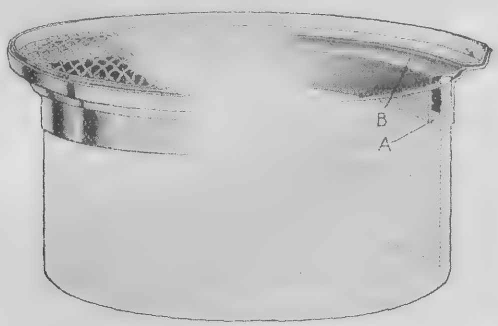
The difficulties involved in raising Hemiptera in captivity are serious. For five consecutive summers we have experimented raising several species

* The *E. variolarius* ♀ used for the cross-breeding experiments was raised in our laboratory from material we collected at Ridgefield, Connecticut, and the *E. servus* were collected at Southern Pines, North Carolina, by Rev. A. H. Manee.

in our laboratory, aiming to learn to raise these bugs with as low a death-rate as possible, and it was not until after three years of experimenting that we felt it would be safe to attempt to cross two or more of these species. The three most troublesome problems in this work were to provide the proper food, to use cages well adapted for cleanliness and observation, and to maintain the right degree of moisture. The bugs must have not only abundant food, but it must be fresh and clean, and these conditions can be successfully met only by frequently transferring the insects to clean cages with fresh food. This should be done at least every third day, or, better still, every second day. We were forced to do this work ourselves, for raising the nymphs demands such delicate care that we were unable to entrust it to an assistant. It proved to be an arduous task during part of the breeding season, when, in our experiments, we found it necessary to change the food for more than 30 cages each day.

The cages we used for the adult bugs were glass dishes about 6 inches in diameter and 3 inches deep. The covers were of coarse brass wire mesh, carefully designed to prevent the possibility of the tarsi of the bugs being caught at any point where the brass cover comes in contact with the glass dish (text-fig. 2). Until we were able to design these covers the bugs were

Fig. 2.



Cage designed to prevent the insects from catching the tarsi at the point of contact between the glass dish and the metal top. The spaces marked A and B are large enough to allow the legs to move about freely, but are too small to admit any part of the body.

frequently mutilated, for if the tarsus is caught, the entire leg of the bug is sacrificed, for the leg always gives way at the proximal end of the femur.

Such mutilation apparently does not seriously interfere with the functional activity of the bugs, for in one case a female that had lost three legs continued to mate and lay eggs quite normally. The greatest danger lies in the fact that a bug in this mutilated condition cannot always regain its normal position if it has, by chance, dropped on its back, for in this position even the adult bugs frequently die in a few hours.

The food chosen for our experiments was wheat and orchard grass while

they lasted, and later in the season timothy heads and berries. The former were placed in the cage in two small bunches, each containing not more than five heads, cut to about 3 inches in length and the stems tightly wrapped together in wet absorbent cotton. If the cotton is kept wet, the food will keep quite fresh for three days.

When blackberries were used, they were not plucked from the stems, but small sprays with berries were selected, cut in lengths of 3 inches, and the stems wrapped in wet cotton. All the leaves were carefully trimmed from each spray, and only one large, or two small sprays were used in each cage. The leaves must be cut off because they hide the bugs, and they are of no value as food—becoming dry in a few hours. It is very important to place the food in the cages in such a way that every bug can be seen at any time and closely watched. When we used strawberries or cherries, we suspended them by their stems from the wire tops of the cage. Frequently we used the tips of young milk-weed, for we found that the bugs in captivity often deposit their eggs on the under side of these leaves, though we have never found any deposited on milk-weed in nature. In order to be sure that all the eggs of our experiments were deposited by the bugs we had under observation, no fresh food was ever placed in the cages without being carefully examined to be sure that no eggs of a kindred species were by any chance brought into the cages. If, however, the food is changed every third day, this danger is practically eliminated, for the eggs of this species require only from 5 to 7 days to hatch, and unless any alien eggs were deposited on the food the same day it was put in the cage, such a mistake would be very readily detected. This particular risk to our experiments was reduced to a minimum in the season of 1912, for the locality where we spent the summer was not only an unfavourable one for Hemiptera, but the exceptional cold of the preceding winter had made the locality even more than usually unfavourable. During the entire summer we succeeded in finding only two specimens of *Euschistus variolarius,* though we constantly searched the wheat fields, berry bushes, &c.

If the food is properly placed in the cages, the bugs can be kept under constant observation. We have frequently watched them deposit their eggs, and were able to note approximately the length of time of each mating. The number of bugs in each cage must necessarily be limited, or accurate observation is impossible. As a rule we never placed more than four pairs in a cage, and as soon as a pair was found mating, they were transferred at once to a separate cage, in which they were kept isolated for the entire breeding season. Thus, for the important experiments, a single pair of bugs was confined in one cage, and each mating and the deposition of each batch of eggs could be accurately noted.

The cages suitable for the adult bugs are of course not suitable for the larval stages, unless a much finer wire mesh is used for the cover. After various experiments we found wet chamber dishes the most satisfactory

cage for the nymphs, care being taken to select a size deep enough for the food and large enough to hold from 20 to 30 nymphs without overcrowding. Sometimes as many as 30 nymphs are hatched from a single batch of eggs, and these may be very active after the first moult. We selected wet chamber dishes, about 120 mm. in diameter and 25 mm. deep. Experiments proved that the nymphs have sufficient air in these dishes, and can be raised with safety through the five moults to the winged stage.

The food suitable for the adult bugs is not satisfactory for the larval stages. Until after the third moult the nymphs are so small that they hide under the petals of the berries and in the grasses, and it requires too much time and patience to find them. The most satisfactory food for these stages proved to be the small, tender leaves that form the centre of headed lettuce. Experiment showed that the nymphs often select these leaves in preference to the berries, and they certainly develop most satisfactorily on this food, through the five moults to the winged stage. During the height of the breeding season we used 15 heads of lettuce a day, as the nymphs were transferred to a clean cage and fresh lettuce every other day. In making this transfer the cage containing the nymphs was carried to a separate table, used only for this purpose. The clean cage, labelled and containing fresh lettuce leaves, was placed on the same table, and the nymphs were carefully lifted from each stale leaf of lettuce to the fresh cage by using a very fine camel's hair brush. The nymphs were carefully counted while moving them from one cage to another, and it very rarely happened that a nymph was accidentally thrown away with the discarded lettuce.

To keep the proper degree of moisture in the cages proved to be a very troublesome problem. A certain amount of moisture is necessary to preserve the food, but if the cotton which is wrapped around the stems of the wheat, &c., is too wet, some of the water may drop on to the glass bottom of the cage, and if a bug falls on its back in even a few drops of water, it frequently cannot regain its normal position, and may die in a few hours. This danger must be controlled, for bugs frequently drop from the top or sides of the cage, and from the food. Too much moisture is even more dangerous for the larval stages. The drops that collect on the inner surface of the glass cover of the wet chamber dishes and fall to the bottom of the dish, mean death to any nymphs that may fall on their backs into even one drop of moisture. It requires constant vigilance to avoid this danger, by frequently wiping off the moisture that collects on the inside of the glass cover. We tried to avoid this risk by placing ordinary filter-paper on the bottom of the cages, but this did not work well, for the tarsi of the bugs frequently caught in the fibres of this coarse paper. But by substituting the German hardened filter-paper for the coarser paper, we got rid of this difficulty. The filter-paper must be cut to fit the bottom of the cages exactly, and it must be kept moist, but not too wet, for too much moisture will rot the delicate lettuce leaves. We have frequently watched the adult bugs, and

also the nymphs, suck the water from this filter-paper, but apparently with no injurious after-effects. We aimed to keep the temperature at 80° Fahr. night and day, and we succeeded in keeping the heat quite constantly at this point by using an electric stove.

It requires unremitting care to raise these Hemiptera in the laboratory. They not only require constant watching during the day, but must be examined two or three times in the night. Not only is this necessary for accurate observations, but if the adults or nymphs are found on their backs, they can be turned over with a camel's hair brush and their lives thus saved.

All our records have been kept with the utmost care. We have recorded not only the number and date of the deposition of the eggs, but the date of hatching, the number hatched in each group, the date when each of the five moults occurred, and a record of just how many young survived each moult. This is very important, in order to know the exact number of nymphs in each wet chamber dish, and thus avoid the danger of unwittingly thowing away a nymph with the stale food. As a rule, the nymphs from a single batch of eggs were kept separate, but late in the season, when only a few nymphs hatched out from a group of eggs, these nymphs, after the 1st or 2nd moult, were added to a cage that contained other nymphs from the same parents. When possible the date and hour of the deposition of each batch of eggs was recorded, though this of course was only possible where the deposition of the eggs was actually observed. In all other cases the time given is only approximate ; but as the food in the cages was arranged to expose to view the places generally selected by the bugs for depositing their eggs, they were not often overlooked, until the food was changed and a closer search was possible. It is very important to secure the eggs as soon as possible after they are laid, for we found that both the male and the female parents will occasionally suck the eggs. Sometimes the male and sometimes the female was found with the proboscis buried in one of the eggs, very busy sucking out the entire contents. They pass from one egg to the next and may destroy a large number of eggs, leaving only transparent empty shells.

Two sets of records were kept for each pair of bugs, one set recording the history of the parents, and the second set recording the development of their offspring.

A full copy of these notes would make too voluminous a record to be published here, but in order to compare the breeding habits of *variolarius*, *servus*, the crosses and the F_1 hybrids, we shall give a condensed extract from these notes, showing for some individual cases, the number of eggs deposited by one female, the relative number that hatched, and the relation between mating and the deposition of eggs. Records I.–XI. pp. 362–70.

We have frequently watched the hatching of the eggs and the subsequent five moults of the nymphs before they reach the winged stage. Nymphs from the same group of eggs that hatched the same day, or even the same

hour, grow very unequally, occasionally a few of them being so retarded that they have reached only the third moult at the time the others have completed the fifth moult. Nymphs showing such greatly retarded development almost invariably die.

Details of Crossing *Euschistus variolarius* ♀ × *Euschistus servus* ♂.

In November 1911, we placed in the same cage three female *variolarius* and five male *servus*, all of which had recently passed the fifth moult. These eight specimens were kept together throughout the following winter. In the spring (May 3rd) one of these *variolarius* females mated with one of the male *servus*, this demonstrating the possibility of crossing these two species. This female *variolarius* was hatched in our laboratory September 11th, 1911. The month before we had collected a few wild specimens of *variolarius* in Ridgefield, Connecticut, in order to secure young, vigorous bugs to carry through the winter for our crossing experiments, and eggs were deposited several times in this cage. It was from one of these groups of eggs that we secured the three females we used for crossing with *servus*. There were 17 eggs in this group, but only seven of them hatched, this being due, undoubtedly, to their having been deposited so late in the season. Six of these seven nymphs—2 males and 4 females—were reared to the winged stage, the 5th moult not being completed until October 16th. Three of these four *variolarius* females were selected to cage with *servus*, and the two *variolarius* males were killed the fourth day after the fifth moult, and preserved in alcohol, in order to avoid the possibility of any question being raised as to the identification of the females as pure *variolarius*. One of these two males is shown on Pl. **28**, photo 6, and the black genital spot, distinctive of the species *variolarius*, is clearly shown. We believe we gained a great advantage by selecting bugs that hatched out so late in the season, for females which reach the winged stage so late as the middle of October are sure to remain all winter as vigorous sexually immature bugs, thus offering the best possible chance for successful breeding experiments in the spring.

The five male *servus* that were kept through the winter with the three female *variolarius*, were hatched from eggs deposited in our laboratory by a female *servus* received from North Carolina the day before the eggs were laid. A group of 10 eggs was deposited September 17th ; 9 of these hatched and 8 were reared to the winged stage, the 5th moult being completed October 28th. Five of these bugs were males, and three females. On November 3rd the five males were added to the cage which contained the three above-mentioned female *variolarius*. In the further description of this cross, this cage will be designated as Cage 2. None of these bugs mated until May 3rd when, as stated above, one pair mated 7 hours (see Record III. p. 364).

As none of these bugs had mated again by May 26th, and the males seemed less vigorous than some wild specimens we had received from North Carolina two days before, we decided to take the five male *servus* from Cage 2, and replace them with three of the wild specimens just received from North Carolina. Three of the five male *servus* that were taken from Cage 2 at this time are shown on Pl. 28. photo 5, and as all five came from the same batch of eggs, these three specimens will serve to demonstrate the species. Each of the three males selected from the wild specimens (to replace the five that were raised in the laboratory) had just mated for several hours with its own species. One was put in Cage 2 May 26th, one on May 27th, and one on May 28th. The next morning at 5 o'clock a pair was found mating, but they separated before we could isolate them. Later in the same day the same female and, probably, the same male mated again. They were then isolated by being left in Cage 2, while the remaining bugs were transferred to another cage. They were kept isolated in Cage 2 until the female died July 16th.

Before the breeding season commenced, one of the three original female *variolarius* had unfortunately been thrown away with the stale food, and we were therefore left with only two of the three original females. One of these was undersize and never mated, though she was in a cage for nearly a month with several wild male *servus*.

We succeeded therefore in crossing only one female *variolarius* with *servus* ; but this proved to be a fortunate circumstance, for this pair was sufficiently fertile to give us all the F_1 and F_2 hybrids that we could possibly care for, as at the same time we were raising hybrids from a cross between *E. variolarius* ♀ and *E. ictericus* ♂.

The female *variolarius* and the male *servus* in Cage 2 mated again June 11th : they mated 51 hours. This was the last time this pair mated, though the female deposited eggs six times after this mating, while normally eggs are deposited only once or twice between two matings.

In order to compare the breeding habits of this cross and of the F_1 hybrids, with the breeding habits of pure *variolarius* and *servus* we will give a brief summary of the data we have collected from our laboratory experiments.

A more detailed account of some of these experiments is given on pp. 362–70, where we have reproduced extracts from our records of eleven pairs of bugs that were isolated through their entire breeding period. All our experiments with *variolarius* and with *servus* indicate that they are alike in certain details of their breeding habits. Records I. & II., pp. 362–3, give what we believe to be the normal breeding habits of both these species. These records show the approximate number of eggs deposited by one female during the breeding season, the approximate intervals of time between the deposition of eggs, the frequency of the matings, and their approximate duration. They show

that mating occurs during the breeding season at rather definite interval in relation to the deposition of eggs, as a rule eggs being deposited only once or twice between two matings. These records show further that nearly all the eggs deposited during the height of the breeding season develop and hatch. The features in which the breeding habits of the crosses differ from the normal can be best appreciated by comparing the following brief summary of the results from the eleven records given on pp. 362–70.

Record I. (p. 362). *E. variolarius* (one pair).—210 eggs were depoited from May 22nd to August 25th. The pair mated 13 times, and eggs were deposited 9 times, but not oftener than once or twice between two matings. None of the eggs deposited after July 25th were kept. Of the 129 eggs deposited before that date all hatched except seven, which were undoubedly injured by the male, for he was discovered sucking them almost immediately after they had been deposited. He had taken the entire contents from two of these eggs, leaving nothing but the transparent shells.

Record II. (p. 363). *E. variolarius* (one pair).—78 eggs were depsited between July 2nd and July 26th. The pair mated 12 times, and eggs were deposited 6 times,—in one instance being deposited 3 times between two matings. None of the eggs deposited after July 10th were kept. Of the 63 deposited before that date all hatched but three. This pair was killed July 26th.

The two records (I. & II.) show what we believe to be the normal breeding habit of both *E. variolarius* and *E. servus*. They show that nearly all eggs develop that are deposited during the height of the breeding season, and that mating occurs oftener than eggs are deposited. They show further that, as a rule, eggs are deposited not oftener than once or twice between two matings. In these three features the crosses vary greatly from the normal, for a very small percentage of the hybrid eggs develop, and mating is very rare. They are, however, quite normal as to the number of eggs deposited, and the intervals of their deposition. The difference between normal breeding and the cross, is shown by the following summary of Record III.

Record III. (p. 364). *E. variolarius* ♀ × *E. servus* ♂.—120 eggs were deposited from May 23rd to July 9th. This is quite the normal number, but an abnormally small proportion of these eggs developed. 83 showed no signs of any development, and were probably unfertilized. Five showed the initial stages of development, but failed to hatch, and only 32 of the 120 eggs developed to the point of hatching. Further, the deposition of many of these eggs was abnormal. They were frequently deposited in small irregular groups, such as those deposited by isolated females that have never mated.

For more than a month during the height of the breeding season—

June 11th to July 16th—this pair did not mate, and during this period eggs were deposited six times, whereas normally eggs are deposited only once or twice between two matings. This female deposited eggs 20 times, and mated only 4 times, wheareas normally mating occurs more frequently than the deposition of eggs. These facts suggest that a more normal proportion of the hybrid eggs might have been developed if the matings had been normal. Whatever condition exists that interferes with the mating of these two species, it is evidently not due to the fact that either the male or the female was functionally inactive, for the female deposited the normal number of eggs at normal intervals, and the male, when temporarily transferred July 2nd to a cage containing three female *servus*, mated the same day with one of his own species, and continued to mate for 42 hours. Further, he had mated with his own species before being caged with the female *variolarius*. July 2nd, we placed a few fresh wild *servus* males in Cage 2, but the *variolarius* female did not mate again, and died, July 16th.

Of the 32 F. 1 hybrid nymphs from this pair, 27 were reared to the winged stage (11 ♂ & 16 ♀). We have photographs of all these eleven males, and ten of them are reproduced on Plate **28**, photos 7 to 14.

There is a marked similarity between the abnormal features of this cross and those of a cross between an F_1 hybrid female and a pure *variolarius* male. To compare the breeding of these two crosses we will give, at this point, a brief summary of the results from Record XI.

RECORD XI. (p. 370). F_1 *Hybrid* ♀ × *Pure variolarius* ♂.—119 eggs were deposited between August 25th and September 18th. Only 36 of these hatched. Eggs were deposited 12 times and mating occurred only once. This pair did not mate a second time, though they were caged through their entire breeding period, which, in this case, did not begin until August 22nd *.

The two crosses of Records III. and XI. resemble each other in the fact that the mating of neither pair was normal, and that an abnormally small proportion of their eggs hatched. They are unlike, however, in that almost a normal proportion of the eggs of the cross of Record XI. showed the initial stages of development. The development, however, was obviously abnormal, and many of these eggs failed to hatch. Of the 36 eggs that hatched, 26 were reared to the winged stage (18 ♂ & 8 ♀). All the males were photographed, and are shown on Plate **34**, photos 62–66. The pure *variolarius* male of this cross is shown on Plate **34**, photo 58.

* In this connection it is interesting to note that an F_1 hybrid ♀ (from *variolarius* ♀ × *icterius* ♂) that was caged with a pure *icterius* ♂, mated normally through the entire breeding season. The female, however, had been kept through the winter, and they mated for the first time June 15th.

F_1 *Hybrids.*—Thirty-two of this generation were hatched (see Record III. p. 364) and 27 were safely reared through the five moults to the winged stage. They hatched between June 4th and July 9th, and reached the winged stage between July 8th and August 3rd.

As soon as they reached the winged stage (*i.e.* after the 5th moult) they were transferred to a large cage and closely watched. As each pair mated, they were isolated, while mating, to a separate cage, and kept isolated throughout the entire breeding period. The eggs from these F. 1 pairs were placed in wet chamber dishes as soon as they were deposited, and the F. 2 nymphs were carried through their entire development in these dishes, until they reached the winged stage, when they were killed and preserved in glycerine, as described on p. 371.

On July 9th and 10th, seven of the F_1 hybrid nymphs reached the winged stage (3 ♀ & 4 ♂). On July 19th two of these F_1 hybrid pairs mated, each pair being transferred at once to a separate cage while mating. They were kept thus isolated through their entire breeding season (see Records IV. and V., pp. 364–5). In this manner we isolated seven pairs of these F_1 hybrids.

Records IV. to X. give the details of these breeding experiments, and a brief summary of the results will show what features are typical of this generation of F_1 hybrids.

Record IV. (p. 364). *First Pair of* F_1 *Hybrids.*—169 eggs were deposited from August 2nd to August 31st. The pair mated 14 times, and eggs were deposited 7 times, and not oftener than once or twice between two matings. Six of the 169 eggs were killed for cytological study, and of the remaining 163, at least 154 hatched. (The number hatched is underestimated, as in two cases, only those nymphs were counted that survived the first moult.) 96 of these nymphs were reared to the winged stage (46 ♂ & 50 ♀).

Forty-three of the males were photographed, and are shown on Plate **29.** Three of the males died in the cage just after the fifth moult. The ventral surface, including the genital segment of these three males, was dark and pathological, and of no value for the demonstration of the genital spot.

A photograph of the male of this pair of F_1 hybrids is shown on Plate **28**, photo 9.

Record V. (p. 365). *Second Pair of* F_1 *Hybrids.*—184 eggs were deposited from August 1st to September 11th. The pair mated 25 times, and eggs were deposited 10 times, and not oftener than once or twice between two matings.

The female was discovered August 1st sucking the group of 28 eggs she had just deposited. She had sucked the entire contents from seven

of the eggs, and she must have injured others, as only eleven of the group developed.

Of the remaining 173 eggs deposited by this female 119 hatched. For some reason we were able to rear only a small proportion of these to the winged stage. We succeeded in rearing only 57 (31 ♂ & 26 ♀). Thirty of these males were photographed, and are shown on Plate **30**. The male of this pair of F_1 hybrids died September 16th. The female was killed September 21st, ten days after the last deposition of eggs.

See photo 14, Plate **28**, for the male of this pair.

Record VI. (p. 366). *Third Pair of* F_1 *Hybrids.*—194 eggs were deposited from July 30th to September 2nd. The pair mated 21 times and eggs were deposited 10 times, and not oftener than once or twice between two matings. Seven of the 194 eggs were killed for cytological study. Of the remaining 187 at least 172 hatched—for the number hatched is underestimated, as in two cases we counted only those nymphs that survived the first moult.

110 of these nymphs were reared to the winged stage (54 ♂ & 56 ♀). Forty-eight of the males were photographed and are shown on Plate **31**. Six males died just after the fifth moult. Two of these are preserved as pinned specimens, and four were destroyed because the ventral surface was dark and the bugs were of no value for demonstrating the genital spot. The male of this pair of F_1 hybrids was photographed, and is shown on Plate **28**, photo 10.

Record VII. (p. 367). *Fourth Pair of* F_1 *Hybrids.*—170 eggs were deposited from August 8th to September 8th. The pair mated 10 times, and eggs were deposited 8 times, and not oftener than once or twice between two matings. Seven of the 170 eggs were killed for cytological study, and of the remaining 163 at least 130 hatched. This number is an underestimate, for in three cases we counted only those nymphs that survived the first moult. We succeeded in raising to the winged stage only 63 of the 130 nymphs that hatched (28 ♂ & 35 ♀). Twenty-seven of these males were photographed and are shown on Plate **32**, photos 42–48.

We were forced to kill this pair September 11th, as we had as many nymphs in the laboratory as we could properly care for. See photo 12, Plate **28**, for the male of this F_1 hybrid pair.

Record VIII. (p. 368). *Fifth Pair of* F_1 *Hybrids.*—110 eggs were deposited from August 8th to September 3rd. The pair mated 10 times and eggs were deposited 6 times, and not oftener than once between two matings. Only 29 of the 110 eggs hatched, and only 16 of these survived to the winged stage (4 ♂ & 12 ♀). The four males were photographed, and are shown on Plate **28**, photos 15 and 16. September 3rd, both male and female of this

pair were killed. We were forced to discard some of the hybrids, and selected this pair because the small percentage of eggs that hatched indicated that they were not functioning normally in spite of the fact that the number of eggs deposited in relation to the number of matings was quite normal. The abnormally large percentage of eggs that failed to hatch may bear some relation to the fact that this female had probably deposited unfertilized eggs before mating, for she was one of two females in a cage in which unfertilized eggs had been deposited.

See photo 11, Plate **28**, for the male of this F_1 hybrid pair.

Before giving a summary of the breeding results of the 6th and 7th pairs of F_1 hybrids (Records IX. & X., p. 369) we must give a brief account of some preliminary experiments.

Two F_1 hybrid females and three F_1 hybrid males* were put in Cage 34 immediately after they had reached the winged stage (between July 9th and 12th). By August 6th none of these bugs had mated, and a group of four unfertilized eggs had been deposited by one of these females.

The two females were then transferred to Cage 36, in which there were 4 F_1 hybrid females and 4 F_1 hybrid males that had not yet mated. At 2 P.M. of the same day two pairs were found mating, and were transferred, while mating, to separate cages (Nos. 43 & 44). We believe these two females were the two that were transferred to this cage from Cage 34, though we have no proof of this. One of these pairs (Cage 43) mated 45½ hours, and on August 12th mated again 6 hours. On August 15th the female died without having deposited any eggs. The second pair (Cage 44) is the Fifth pair of F_1 hybrids described above (Record VIII.).

Cage 36 now contained 4 females and 2 males that had never mated. The two males resembled bugs that are found in the fall after the breeding season: the ventral surface had become hard and grey, instead of a fresh green colour, which is typical at the breeding period.

On August 15th we added to this cage the male that had mated August 12th in Cage 43. Ten minutes after this male was put into Cage 36 he mated with one of the four females, and the pair was transferred, while mating, to Cage 46. They mated 15½ hours. There now remained in Cage 36 the three females and the two males with grey venter, none of which had mated. One of these females, however, had a fresh green venter and showed other signs of functional activity.

August 16th, we removed the two males with grey venter from this cage (36) and added the male from Cage 46 that had just mated. At

* Two of these males were killed August 11th and the testes mounted for cytological study. The bugs were preserved and are shown on Plate 28, photo 7. The third male was killed August 13th and preserved as a pinned specimen.

2 P.M. of the same day the female with the green venter mated with this male, and we transferred the pair to Cage 48. Thus the two females of Cages 46 & 48 were fertilized by the same male. The two grey venter males that had never mated were put back into Cage 36, which now contained these two males and two females, none of which had mated. On August 28th these four bugs were killed and preserved. The two males are shown on Plate **28**, photo 8. The male that had mated with the two females (Cages 46 & 48 = Records IX. & X.) was transferred after each mating from one of these cages to the other during the rest of the breeding season. We hoped we could raise enough offspring from each of these two females for a comparative study of the transmission of the genital spot through two different females fertilized by the same male. We were, however, disappointed in this, as we succeeded in raising only seven males from one of the two females —not enough to be of value for comparative study.

The results, briefly, are as follows :—

RECORD IX. (p. 369). *Sixth Pair of* F_1 *Hybrids.*—134 eggs were deposited from August 22nd to September 19th. The pair mated 11 times, and eggs were deposited 10 times, and not oftener than once or twice between two matings. Only 33 of these 134 eggs developed to the point of hatching, although a great many more were fertilized, and there was no obvious reason why they did not hatch. Only 13 of these nymphs survived to the winged stage (7 ♂ & 6 ♀). Six of the males were photographed and are shown on Plate **32**, photos 49 & 50. The male of this pair was killed September 19th and the female September 21st. The male was photographed and is shown on Plate **28**, photo 13 (this male fertilized also the female of Record X.).

RECORD X. (p. 369). *Seventh Pair of* F_1 *Hybrids.*—120 eggs were deposited from August 20th to September 8th. The pair mated 8 times, and eggs were deposited 8 times, and in only one instance were they deposited more than twice between two matings.

104 of these 120 eggs hatched, and 68 of the nymphs were reared to the winged stage (34 ♂ & 34 ♀). Thirty-two of these males were photographed and are shown on Plate **33**, photos 51–57. Two males died in the cage just after the 5th moult, and were destroyed because the ventral surface was dark and pathological.

The above summary of the records of the seven F_1 hybrid pairs shows several features that are apparently typical of this generation of hybrids. These records show further, that if the F_1 hybrids can be secured, the F_2 generation can be obtained in large numbers. The F_1 hybrid generation is quite as fertile as the original pairs of either pure *variolarius* or pure *servus*

during the height of the breeding season, and it is interesting to note that in this fertility they resemble the F_1 generation of *servus*, but not of *variolarius*, for in our experience we have only one case on record in which the F_1 generation of pure *variolarius* mated and deposited fertile eggs the same season. If these records (IV. to X.) are compared with Records I. and II. of pure *variolarius*, it will be seen that, although the F_1 hybrids are not quite normal as to the percentage of eggs that develop, they are entirely normal as to the relation between mating and deposition of eggs, for eggs are deposited only once or twice between two matings, and the matings far exceed in number the deposition of eggs.

The records show that towards the end of the breeding season mating became more frequent, in some cases the breeding season being closed by a series of matings of short duration, which continued several days after the last deposition of eggs. This we believe is characteristic of *servus*, and was typical also of the F_1 generation of two other species we received from the South—*E. ictericus* and *E. crassus*.

We realize our experiments have not been sufficiently numerous to warrant definite conclusions as to the breeding habits of the species we have studied, but they furnish reliable data as far as the limited number of experiments admit. The higher death-rate of the F_2 generation, both as to the eggs and nymphs, we believe was due in part to the fact that the weather was unseasonably cold, and a proper degree of temperature and moisture could not always be satisfactorily maintained for all the cages.

In order to repeat these experiments on a larger scale, a much more elaborate equipment should be available. The bugs should be kept in a hot-house where temperature and moisture can be properly regulated, and the lettuce used for food should be cultivated under supervision, to be sure that no insecticides are used in its cultivation. Further, a number of trained assistants is absolutely necessary. The material furnished by a single cross is at some period of the experiments more than two workers can properly care for. We were forced to cut short several important experiments on account of the impossibility of continuing satisfactorily the extra work they involved.

We believe that our success in being able to cross even one pair of *variolarius* and *servus* is due to the fact that the two females used for the experiments, hatched after the close of the breeding season, and were kept through the following winter. This belief is supported by the fact that we did not succeed in repeating the cross-breeding experiments during the summer with bugs of the first generation of that season, though we tried this with 16 female *variolarius* and 14 male *servus*. These experiments were carried on in three cages, the first started June 22nd, the second June 28th, and the third July 2nd. All the female *variolarius* had been raised in our laboratory during the early summer, and were transferred to these cages

immediately after reaching the winged stage. Five of the male *servus* used in these experiments were raised in our laboratory, and like the *variolarius* females, were transferred to the experiment cages immediately after reaching the winged stage. The other 9 males were wild specimens, received from North Carolina. These experiments were continued for nearly two months, and no mating occurred at any time. The experiments were not closed until many unfertilized eggs had been deposited in all the cages *.

Possibly nymphs captured in the field, and raised to maturity in the laboratory may be more easily bred from; but in our experience we have never been able to collect the wild nymphs early enough in the season to succeed in breeding them with each other, or with an alien species.

The reciprocal cross with the first generation (♀ *servus* & ♂ *variolarius*) also proved unsuccessful; these experiments, as in all other cases, being continued until unfertilized eggs had been deposited a number of times in each cage.

We believe our lack of success in these cross-breeding experiments was not wholly due to the fact that the males and females were of different species, for we were almost as unsuccessful in getting a second generation of pure *variolarius*, though we had much better success in raising the second generation from *servus*. The first generation of this species mated from 10 to 18 days after they reached the winged stage, and were very fertile.

Fortunately for the success of our cross-breeding experiments, the F_1 hybrids resembled *servus* and not *variolarius*, in that most of them mated readily in captivity, from 10 to 20 days after the last moult, and like the first generation of *servus* proved to be very fertile.

The following experiments show it is much more difficult to get a second generation from *variolarius* the same season, although the first generation, if kept through the winter, will normally mate and deposit eggs early in the spring.

In 1911 we experimented with a few pairs of young *variolarius*, all reared from the same batch of eggs. About twenty days after they had reached the winged stage, a few males and females were placed in the same cage, from August 6th to August 27th. During this period they did not mate once, though the females deposited unfertilized eggs, and dissection showed the males to be apparently sexually mature. Two females and four males from this same batch of eggs were carried through the following winter, and in

* As a rule unfertilized eggs are deposited quite differently from those that have been fertilized. The latter are deposited in flat, symmetrical groups containing sometimes more than 30 eggs, and all adhering together. Unfertilized eggs, on the contrary, are dropped here and there on leaves, grasses or berries, sometimes only one or two eggs at a time, or more frequently in groups of three, four, or five. We never destroyed the unfertilized eggs until ten days after their deposition, although fertilized eggs always show the initial stages of development on the 3rd or 4th day.

the spring they mated and deposited eggs quite normally; 330 eggs being deposited by the two females before July 9th, when they were killed. It was from these eggs that we raised the *variolarius* specimens used for the above described unsuccessful cross-breeding experiments with *servus*. We also tried to breed from several of this first generation of *variolarius* to use as a control for our cross-breeding experiments, and to test the above described experiment of 1911 with the first generation of that season. We had three cages of these experiments in 1912, including in all 18 females and 13 males. The first cage was started July 15th, and these experiments were not closed until August 29th. During this period only one pair* of these 31 bugs mated (August 16th) though many unfertilized eggs were deposited in the three cages. The fact that in all these experiments unfertilized eggs were deposited, proves that the young females function the same season, but our experiments indicate that the young males rarely function until the next spring. The following experiments bearing on this point may be added to those already given. As stated above, the young pairs of *variolarius* that were caged in 1911 did not mate, although the females deposited unfertilized eggs. Thinking this might be due to the fact that these bugs were all from the same batch of eggs, we caged one of these F_1 males with a wild female that had just mated with a wild male. They did not mate, however, although the female continued to deposit eggs at normal intervals until August 22nd, and was not killed until September 26th.

In the season of 1912 we were anxious to test this experiment by caging wild males, after they had mated in the laboratory, with young females that were depositing unfertilized eggs, but we did not succeed in capturing any *variolarius* males that season, though we searched ourselves, and had assistants searching also.

That the young *variolarius* males rarely function the same season in the laboratory was again indicated by the following experiment. Five young *variolarius* males had been caged for five weeks with five F_1 hybrid females, and had not mated once, although the females had deposited 88 unfertilized eggs. Thinking that perhaps these males might be sexually immature, they were replaced by the one young *variolarius* male that had mated in the laboratory that season. Eleven days later this male mated with one of the F_1 hybrid females (see Record XI. and p. 345).

These facts would seem to indicate that the young male *variolarius* are not as a rule sexually mature the same season they are hatched, but the evidence on this point is entirely inadequate as proof. *Variolarius* females that were depositing unfertilized eggs also failed to mate with the F_1 *servus* males, and these males were undoubtedly sexually mature, for they breed readily

* This pair was transferred to a separate cage while mating, and used for experiments described below. The male of this pair is shown on Plate **34**, photo 58.

with their own species. This may indicate that possibly the factor of selection may be in part responsible for some of the failures of our breeding experiments.

We raised only 10 ♂ and 22 ♀ from the one pair of young *variolarius* that mated in the laboratory in 1912. We undoubtedly would have had more, but the female was fertilized only once, as we transferred this male to the F_1 hybrid females, as described above. This *variolarius* female deposited 58 eggs from August 17th to September 7th, and 36 of these hatched, 32 being reared to the winged stage (10 ♂ & 22 ♀). The F_1 hybrid female that was fertilized by this same male deposited 119 eggs and 36 hatched.

The males from these two females were photographed and are shown on Plate **34**. Photos 59 to 61 show the males from the pure *variolarious* pair, and photos 61 to 66 show the males from the F_1 hybrid female and the pure *variolarius* male.

These photographs demonstrate that the spot is inherited through the pure *variolarius* female (photos 59 to 61) more intensely than it is through the F_1 hybrid female (photos 62 to 66), and a comparison of photos 62 to 66 with those when both parents are F_1 hybrids, Plates **29–33**, demonstrates that the spot is transmitted through a pure male *variolarius* much more strongly than through an F_1 hybrid male. All such facts bearing on the inheritance of the genital spot are important in testing modern chromosome theories of sex-determination in the light of the transmission of this exclusively male character.

Discussion.

Any analysis of the results of cross-breeding experiments involves a discussion of their bearing on fundamental problems of heredity, and we should examine the facts demonstrated by our recent experiments in the light of the popular theories which claim to offer a partial solution of some of the important problems of heredity. The hypothesis of first interest to the cytologist is the one that claims to offer an explanation of the transmission of characters by the assumption that the factors essential to their transmission are carried and distributed by definite chromosomes, but a discussion of our results from this point of view is reserved for a paper in which the cytological phenomena can be fully demonstrated by photographs. A brief statement of the facts and their bearing on recent chromosome theories was given in the preliminary report of our work ('13).

In the present paper we shall merely restate the facts and conclusions in order to present the evidence in detail, as it is demonstrated in the photographs of Plates **28–34**.

First. The results demonstrate that an exclusively male character (the genital spot) can be inherited without the aid of the Y chromosome. This is

proved by the fact that it is transmitted through the female, and the female does not have the Y chromosome, as this chromosome is an exclusively male character. Photographs 7–57 show the males of the F_1 and the F_2 generations. All these males are the hybrid descendants of one pure *variolarius* female, that was fertilized by *servus*—the species that has *no* genital spot; and these hybrids show beyond question that the spot can be transmitted through the female, some of the F_2 males having as pronounced a spot on the genital segment as that of the *variolarius* males: *e. g.*, one or more of the specimens of photos 15, 23, 26, 28, 32, 34, 35, 36, 40, 41, 46, 48, 55.

Second. The results demonstrate that the genital spot can be inherited without the aid of the X chromosome. This is proved by the fact that it is transmitted through the male, and the male-producing spermatozoon does not have an X chromosome. Photos 62 to 66 show the males from an F_1 hybrid ♀ × a pure *variolarius* ♂, and a comparison of these photographs with those of the F_2 hybrid generation (photos 15 to 57) shows that the genital spot is inherited much more strongly from the pure *variolarius* male than through the F_1 hybrid males; this fact demonstrating that the male *variolarius*, as well as the female *variolarius*, can directly transmit the spot to the males. As, according to the hypothesis, these can be inherited directly from the male, only through the male-producing spermatozoon, which has no X chromosome: it follows that the spot can be inherited without the aid of the X chromosome. This back cross further demonstrates, not only the direct inheritance of the spot from the male, but also the inheritance of the *servus* character, absence of spot. This was transmitted to the F_1 ♀ by the pure *variolarius* ♀ of the first cross, and therefore *ex hypothesi* it must have come from the female-producing spermatozoon of *servus*. This back cross therefore demonstrates that an exclusively male character—the genital spot—can be transmitted by the male-producing spermatozoon, and an exclusively male character—the absence of spot—can be transmitted by the female-producing spermatozoon, and that therefore these so-called sex-determining spermatozoa do not differ functionally in their transmission of an exclusively male character. In making these deductions, it is, of course, necessary to accept, for the sake of the argument, the assumption of male- and female-producing spermatozoa, an assumption which, we believe, is far from being proved.

Third. The results show that if we assume that the factors necessary for the production of the genital spot are located in any of the ordinary chromosomes, they must be in at least both members of a pair of ordinary chromosomes, for the spot is directly transmitted through both the male and the female.

Fourth. The results show that if we assume that the factors necessary for the production of the genital spot are carried by both members of a pair of chromosomes, we must assume that the female carries an inhibitor for the

spot, as the spot is never present in any of the females, neither in the pure *variolarius* nor in the hybrids, although the fact that it is transmitted by the female *variolarius* proves that the spot factors are present in the female, though not expressed.

Fifth. The results show that, although it is necessary to assume an inhibitor only in the females of pure *variolarius*, *in the hybrids it becomes necessary to assume an inhibitor in the males also.* The F_1 hybrid males show the spot either very incompletely, or not at all, although they can transmit the spot to the next generation, and therefore they must carry the factors necessary for its transmission, in spite of the fact that the appearance of the spot in the F_1 generation is partly or wholly inhibited. The two F_1 hybrid males of photo 7 have no spot *, the upper F_1 male of photo 8 has merely an indication of a spot and in the lower bug it is not much stronger. The F_1 males of photos 9 to 13 have a very insignificant spot, and the F_1 male of photo 14 has merely a trace of a spot, although the offspring of these males frequently have a spot quite as pronounced as that of pure *variolarius*. Compare these F_1 males with one or more of the F_2 males of photos 15, 23, 26, 28, 32, 34, 35, 36, 40, 41, 46, 48, and 55.

Sixth. The facts show that if we attempt to place this inhibitor in definite chromosomes, we meet as serious difficulties as those involved in assuming that the factors essential for the production of the genital spot are carried by special chromosomes. In our preliminary report of these experiments ('13), we discussed in full the evident results of placing this inhibitor in various chromosomes: in the X chromosomes, in one of the ordinary chromosomes, or in a pair of chromosomes, and we found that none of these assumptions would accord with the facts. The facts force us to regard these inhibitors as hypothetical forces which cannot logically be confined to the chromosomes, and are located we know not where—these hypothetical inhibitors practically doing work that has been assigned to definite chromosomes. As stated in the above-mentioned preliminary report, "the facts force us to consign to these hypothetical inhibitors, not only the responsibility of suppressing the spot factors in all the females, but also of determining just how many spot factors shall find expression in the males of the F_1 and F_2 generations, and thus they practically relieve the chromosomes of the burden of unit distribution."

It would seem then that the facts are out of harmony with the theories that offer an explanation of the transmission of characters on the assumption that the factors essential to their transmission are carried and distributed by definite chromosomes.

* The two dark specks on the genital segment of the upper bug, close to the base of the segment, must not be confused with the genital spot. In the lower bug a slight indication of a spot can be seen with a lens, but it will probably not appear in the print.

If we examine the results of our experiments in the light of Mendel's law of heredity, we find that the genital spot does not behave as a Mendelian unit. Professor Punnett (1911) defines a unit-character as follows: "Unit-characters are represented by definite factors in the gamete which, in the process of heredity, behave as indivisible entities, and are distributed according to a definite scheme. The factor for this or that unit-character is either present in the gamete, or it is not present. It must be there in its entirety, or be completely absent." (Page 42.)

Whatever determines the genital spot in these hybrids, it cannot be an indivisible unit-factor, which is "present in its entirety" or is "completely absent," for the genital spot is not present as a whole, or completely absent. If we speak of it in terms of Mendelism, we must say that it is the result of a number of unit-factors, for in the hybrid males of the F_1 and F_2 generations in which a spot can be identified, it is present in every degree of intensity, from a mere indication of a spot, to that of the F_2 generation which is quite as conspicuous as the spot of a pure *variolarius*.

Neither the spot nor its absence is dominant in the F_1 hybrids. There is certainly an absence of dominance in this F_1 generation. Of the eleven F_1 male hybrids, 2 have no spot (photo 7): 4 have a spot so faint that it is barely visible (photos 8 and 14 and one pinned specimen); and 5 have a spot about one third as pronounced as that of a pure *variolarius* (photos 9, 10, 11, 12, and 13).

It is evident also that the spot of these F_1 hybrids is not a true blend, for only one parent is represented by the two specimens that have no spot, and there is quite as much variation in the size and intensity of the spot of the remaining nine specimens as is found in any nine intermediates of the F_2 generation.

The F_2 generation shows apparently a greater variability than the F_1 generation, for in the former *both* extremes are represented, some of the males having a spot as pronounced as that of pure *variolarius*, while some have no spot whatever, and the remainder have the spot in varying degrees of size and intensity. These facts may be of value as offering a test such as Castle (1911) has suggested, by which it may be possible to decide whether the results can be classed with the Mendelian type of inheritance, or with that described as a "non-Mendelian, non-segregating type of inheritance." Castle says: "There is one means by which we can determine with certainty whether, in a particular case of seemingly blending inheritance, segregation does or does not occur, namely by comparing the variability of the F_1 and F_2 generations. If segregation does not occur, F_2 should be no more variable than F_1, whereas if segregation does occur, F_2 should be more variable." (Page 137.)

Although the F_2 generation of our *Euschistus* hybrids shows more variability than the F_1 generation, the value of this as proof is weakened, if not

cancelled, by the fact that the two generations are not equally represented, and cannot therefore be justly compared. We have 190 males of the F_2 generation in which the exact condition of the spot can be determined, and only 11 males of the F_1 generation; and therefore it would not be reasonable to conclude from such inadequate data, that the F_1 generation of these hybrids is less variable than the F_2 generation. We are inclined to believe that if the number of the F_1 hybrid males were equal to that of the F_2 generation, they would show both extremes of the inheritance of the spot, and a variability quite as pronounced as we find in the F_2 males.

Some of the males of the F_2 generation might be assumed to be pure dominants and recessives, for some have the spot as fully developed as that of pure *variolarius* (one or more of the specimens of photos 15, 23, 26, 28, 32, 34, 36, 40, 41, 46, 48, and 55), while others have no spot whatever (one or more of the specimens of photos 16 to 39, 43, and 51 to 56). The intermediates show the spot in a very variable degree of intensity, but if these latter are assumed to be "visible heterozygous forms" of Mendelian segregation, there should be an equal number of pure dominants and recessives, whereas there are only 19 that have the perfect *variolarius* spot, and 74 in which the spot is absent.

If we would attempt to find a theoretical explanation of the results, we must first devise a formula that will work for pure *variolarius*, and the facts compel two assumptions in the making of such a formula. First, we must assume that the female is homozygous for the spot factors, and second, that she has an inhibitor for the spot and that she does not transmit this inhibitor to her male offspring. The necessity for this last assumption seems obvious, because the spot is *never* inhibited in the male. If we would assume, however, that both sexes can have an inhibitor, an assumption that some facts in the hybrids demand, then we must assume that it requires a double dose to inhibit the spot; and to insure the spot being a constant character, we must assume that in the male the inhibitor is not only heterozygous but sex-linked. But this assumption, which would hold for *variolarius*, would not work for the cross, because the *female hybrids* would in this case be heterozygous instead of homozygous for the inhibitor, and would therefore have the spot. If to obviate this difficulty we assume that *servus* also has an inhibitor, this would inhibit the spot in the F_1 hybrid *females*, but in *none* of the F_1 *hybrid males*, whereas in fact, the spot is completely or partially inhibited in *all* the F_1 hybrid males.

The necessity of the assumption that the female *variolarius* is homozygous for the *spot factors* is quite obvious, for the genital spot could not remain constant if we assume that the female is heterozygous for the spot factors, unless we add the unwarrantable assumptions that the female is heterozygous and the male homozygous for sex, and that the spot factors are linked with the sex-factor.

We seem compelled, therefore, to assume that the female *variolarius* is homozygous for the spot factors ; and if we assume that *servus* is without them, then the F_1 hybrids should be heterozygous for these factors. Assuming that they are inhibited in the female, the males should *all be alike*, either in having a *variolarius* spot or in having no spot. The facts, however, are as follows :—Two of the eleven F_1 hybrid males have no spot (photo 7), and the remaining nine are variable intermediates (8 of the 9 are shown in photos 8–14, and the 9th is a pinned specimen, which has a spot so small and so faint that it is scarcely perceptible).

An interesting case of F_1 hybrids approximating a blend is the cross between the pigmented silky hen and the unpigmented brown leghorn. Prof. Punnett theoretically explains these intermediates (partly pigmented) F_1 fowls by the following assumptions :—

1st. Assumes that the ♀ is heterozygous for femaleness (Ff).
2nd. Assumes that the ♂ is without this sex-factor (ff).
3rd. Assumes that the silky is homozygous for the pigment factor (PP).
4th. Assumes that the silky is without an inhibiting factor (ii).
5th. Assumes that the brown leghorn is without the pigment factor (pp).
6th. Assumes that the brown leghorn is homozygous for an inhibiting factor (II).
7th. Assumes the inhibitor is sex-linked (there is a repulsion between I and F).

If we transfer all these assumptions to the *variolarius* × *servus* cross, even to the extent of assuming that the female instead of the male is heterozygous for the sex factor, they fail to account for the fact that these F_1 hybrids are not *all* intermediates.* *Two are like* servus *in having no spot.* Such irregularities in the F_1 generation are out of harmony with the principles of Mendelism, but in some forms similar evidence against Mendelism has been weakened, if not cancelled, by the fact that the F_2 generation shows a regular Mendelian ratio. This is not the case, however, with the F_2 generation of the *Euschistus* cross—of the 190 F. 2 male hybrids (photos 15–57), 19 have the spot quite as distinct as that of pure *variolarius*, 97 are very variable intermediates, and 74 are like *servus* in having no spot.

The classification of the F_2 hybrids into these three groups is based on a study of the photographs,† and the numbers in each group were afterwards

* It is obvious that in the *females* of *variolarius* a special inhibitor must be assumed that is outside the germ plasm—for *theoretically* the spot appears in the female.

† In classifying the photographs of the hybrids we included under the *servus* type not only all those specimens with no spot whatever, but also those with merely a faint indication of a spot, for the latter was not visible in the living specimens, and probably will not show in the reproductions.

compared with those based on a study of the original specimens immediately after the bugs were killed. The two sets of figures agree almost exactly, differing only in the fact that in the original estimate we classed two specimens as *variolarius* and two as *servus* which we now class as intermediates. Such a variation in the classification is unavoidable because the intermediates blend into the two extremes, and it is not always clear into which division a specimen belongs. Possibly the printing of the photographs in the final plates may be too light in some cases, and fail to bring out a faint spot that should be classed as an intermediate and not *servus*, and this would cause some slight variations from the above figures. If we consider separately the ratio from each of the seven pairs of F_1 hybrids, the results are as follows :—

F. 2 males from the seven pairs of F_1 hybrids.

	1st pair. Plate **29**, Photos 17–25.	2nd pair. Plate **30**, Photos 26–32.	3rd pair. Plate **31**, Photos 33–41.	4th pair. Plate **32**, Photos 42–48.	5th pair. Plate **28**, Photos 15–16.	6th pair. Plate **32**, Photos 49–50.	7th pair. Plate **33**, Photos 51–57.	Totals.
Spot like *variolarius.*	1	3	8	4	1	0	2	19
Intermediates.	17	12	27	18	2	5	16	97
No spot like *servus.*	25	15	13	5	1	1	14	74

Of these seven pairs of F_1 hybrids only the 5th pair shows a simple Mendelian ratio (1 like *variolarius*, 2 intermediate, and 1 like *servus*), a ratio which evidently would not have been maintained if a large number of offspring had been secured, for no such ratio is shown by the F_2 hybrids from any of the remaining six pairs, all of which have a larger number of offspring. If one is willing to readjust these ratios by filling the gaps with the nymphs that died and those that failed to hatch, it would be possible of course to create any ratio required, but the assumptions cannot be the same for the seven pairs, and this fact would weaken the value of such an adjustment.

We may further search for a Mendelian ratio (half pure and half hetero zygous) in the cross between the F_1 hybrid ♀ and the pure *variolarius* ♂. From this cross we raised 18 males (photos 62–66). 12 of these 8 males

have the spot as strong as *variolarius*, 3 have a spot so small and faint that it is scarcely perceptible (the lower two specimens of photo 62, and the lowest specimen of photo 66), and 3 are quite typical intermediates (the 3rd and 5th specimens of photo 64, and the second specimen of photo 66). Thus 12 of these males have the *variolarius* spot, 3 are intermediates, and 3 are almost without a spot. It therefore seems obvious that a Mendelian ratio is not shown in any of the experiments, it does not appear in the F_1 hybrid generation, in the F_2 hybrid generation, nor in this generation from an F_1 hybrid ♀ by pure *variolarius* ♂.

The above-mentioned cross (F_1 hybrid ♀ × pure *variolarius* ♂) is important because it shows that the genital spot is not a sex-linked character. The test of whether a character is linked to a factor that determines sex is usually made by the "reciprocal cross," which in this case would be pure *servus* ♀ × pure *variolarius* ♂. It is assumed that the parent that is heterozygous for sex can transmit a sex-linked character only to the opposite sex, and therefore none of the males from such a cross should inherit the spot. We were unable to attempt this cross, but the above-mentioned experiment (F_1 hybrid ♀ × pure *variolarius* ♂) shows quite as conclusively as a "reciprocal cross" whether the genital spot behaves as a sex-linked character. This cross demonstrates that the genital spot does *not* behave as a sex-linked character, for it shows that the male *variolarius can directly transmit* the spot to his male offspring, for these offspring show the greatly increased strength of its inheritance from the pure male as compared with its inheritance from the F_1 males.

We cannot explain this exclusively male character by simply assuming that the constitution of the eggs inhibits the expression of the spot in the female, for this leaves unexplained the fact that the spot is partly or wholly inhibited in the F_1 *males.*

We have been unable to harmonize our results either with the Mendelian or non-Mendelian (blend) type of inheritance—the great variability of the F_1 hybrids being the most obvious difficulty. The assumption of multiple factors may be satisfactory as an explanation of the variability of the F_2 intermediates; but it does not explain the variability of the F_1 hybrids. On the assumption of multiple factors the F_1 hybrids should be alike—subject only to minor variations (fluctuations). This, however, is not the case—2 have no spot and 9 are variable intermediates.

Castle's assumption of change in potency of a given factor or factors seems more in harmony with the facts, for this offers not only an explanation of the variability of the F_2 intermediates, but admits any degree of variability in the F_1 hybrids—even to the extent of reversing dominance.

We cannot logically explain the facts on the assumption of variation in potency of a single spot factor, for on this assumption the spot of pure *variolarius* should show the same relative amount of variation, which is not the case. But if we assume that *servus* has an inhibitor which also varies in potency, then the F_1 spot, besides being more or less reduced by a single dose of spot factor which varies in potency, can be further reduced or wholly cancelled by the *servus* inhibitor, according to the degree of its potency.

The hypothesis of varying potency of unit factors demands the presence of at least a perceptible variation in the spot of pure *variolarius*, and such a variability does, in fact, occur. This irregularity can be best appreciated by comparing the male offspring from the same parents.

Castle (1912) says: "In my experience *every* unit character is subject to quantitative variation, that is, its expression in the body varies." The fundamental explanation of his striking results in selection is the assumption that these variations have a germinal basis and are inherited.

It seems to us that our results are more in harmony with Castle's assumption of the varying potency of unit factors; but if they do in fact admit of a pure Mendelian interpretation, this must be left to the specialist in genetics.

APPENDIX I.

Since this paper was finished, striking corroborative support has been given to the results of our experiments.

In expressing to Professor Poulton our desire to find an experienced Entomologist who would look over the parent species of our hybrids for some distinguishing character (other than the genital spot) that might give additional evidence in support of our experiments, Professor Poulton kindly suggested Dr. Harry Eltringham, of New College, Oxford. We feel very grateful to Professor Poulton for his interest and courtesy in this matter, and we are deeply indebted to Dr. Eltringham for his very valuable discovery of the marked difference in the length of the intromittent organ of *E. variolarius* and *E. servus*. As a result of his observation, we have been able to follow out the inheritance of this second exclusively male character in the hybrids from this cross, as well as from the cross between *E. variolarius* and *E. ictericus*.

APPENDIX II.

Records of Eleven Pairs of Bugs that were Isolated through their Breeding Period.

As details of breeding experiments can be of value or interest only to those who may care to repeat such experiments with the same or allied species, we have not published the following details in the text, but have added them here in a convenient form for reference.

The following records are extracts from our notes. We have selected only the main points essential for comparison, omitting such details as the dates of hatching, the dates of the five moults, and the number of nymphs that survived each moult, &c., &c. The length of time given for each mating is the minimum, as it is estimated from the time the pair was found mating until the last record before they were found apart. The bugs were closely watched during the day, and observations made two or three times during the night. The number of eggs that hatched is also the minimum, for in some cases we counted only those nymphs that survived the first moult. Before the first moult these small bugs generally keep closely segregated in a compact mass, and it is impossible to count them accurately when a large number is hatched.

Record I. Cage 2.—1911.

One Pair of *E. variolarius*.

(Collected April 16th, at White Plains, New York, by J. R. de la torre Bueno.)

April				
20th.	6.30 A.M. mating:	continued to mate	$9\frac{1}{2}$ hours.	
28th.	5.00 P.M. ditto	ditto	19 hours.	
May				
2nd.	1.30 P.M. ditto	ditto	$17\frac{1}{2}$ hours.	
7th.	6.00 A.M. ditto	ditto	9 hours.	
10th.	6.00 A.M. ditto	ditto	15 hours.	
22nd.	4 eggs, all hatched: 3 reared to winged stage—(2 ♂ & 1 ♀).			
June				
9th.	29 eggs, 20 hatched. (Found the ♂ sucking these eggs: had sucked the entire contents from two.) 16 reared to winged stage—(7 ♂ & 9 ♀).			
26th.	5.30 A.M. mating:	continued to mate	$3\frac{1}{2}$ hours.	
July				
1st.	28 eggs, all hatched: 15 reared to winged stage—(9 ♂ & 6 ♀).			
7th.	28 eggs, all hatched. Killed all after 3rd moult to preserve as nymphs.			
13th.	5.30 A.M. mating:	continued to mate	$6\frac{1}{2}$ hours.	
14th.	5.30 A.M. ditto	ditto	$4\frac{1}{4}$ hours.	

JULY	
20th.	5.00 A.M. 28 eggs, all hatched. Killed all after 1st moult to preserve as nymphs.
20th.	5.00 A.M. mating: continued to mate 3 hours.
23rd.	5.30 A.M. ditto ditto $5\frac{1}{2}$ hours.
25th.	12 eggs, all hatched. Did not keep these nymphs beyond the 2nd moult.
AUGUST	
5th.	42 eggs, in 3 groups. These eggs not kept.
6th.	5.00 A.M. mating: continued to mate 4 hours.
10th.	11 eggs. These eggs not kept.
19th.	5.30 A.M. mating: continued to mate 27 hours.
23rd	5.30 A.M. ditto ditto $6\frac{1}{2}$ hours.
25th.	28 eggs. These eggs not kept.
31st.	The female died. Killed the male and preserved the pair in alcohol.

RECORD II. CAGE 10.—1911.

One Pair of *E. variolarius.*

(Collected April 16th, at White Plains, New York, by J. R. de la torre Bueno.)

APRIL	
18th.	7.00 A.M. mating: continued to mate 6 hours.
22nd.	7.30 A.M. ditto ditto $8\frac{1}{2}$ hours.
25th.	1.00 P.M. ditto ditto $5\frac{1}{2}$ hours.
28th.	6.30 A.M. ditto ditto $4\frac{3}{4}$ hours.
MAY	
1st.	6.30 A.M. ditto ditto $6\frac{3}{4}$ hours.
10th.	6.00 A.M. ditto ditto $27\frac{1}{2}$ hours.
23rd.	6.00 A.M. ditto ditto $33\frac{1}{2}$ hours.
JUNE	
6th.	6.00 A.M. ditto ditto 14 hours.
17th.	5.30 A.M. ditto ditto 14 hours.
JULY	
2nd.	28 eggs (watched the ♀ depositing some of these eggs): 27 hatched. Nymphs not kept after 3rd moult.
3rd.	5.30 A.M. mating: continued to mate 36 hours.
5th.	14 eggs, 12 hatched. Killed after 2nd moult to preserve as nymphs.
7th.	13 eggs, all hatched. Nymphs not kept after 2nd moult.
10th.	8 eggs, all hatched. Nymphs not kept after 1st moult.
12th.	5.30 A.M. mating: continued to mate 29 hours.
16th.	3.30 P.M. ditto ditto $19\frac{1}{2}$ hours.
20th.	10 eggs. These eggs not kept.
26th.	5 eggs. ditto.
26th.	Killed both the ♂ & ♀ and preserved. We were forced to kill this pair as at this period we had as much living material in our laboratory as we could properly care for.

Record III. Cage 2.—1912.

E. variolarius ♀ × *E. servus* ♂.

May
3rd. 3.00 P.M. mating: continued to mate 7 hours.
23rd. 1 egg, unfertilized (did not show the initial stages of development).
27th. 7 eggs, ditto ditto
28th. 6 eggs: one developed and hatched.
29th. 5.00 A.M. mating: continued to mate 15 minutes.
29th. 1.15 P.M. ditto ditto 18 hours.

June
2nd. 17 eggs: 3 apparently unfertilized, 14 hatched.
8th. 5 eggs: 3 apparently unfertilized, 2 hatched.
11th. 18 eggs, in 3 groups: 12 apparently unfertilized, 6 hatched.
11th. 3.50 P.M. mating: continued to mate 51 hours.
14th. 13 eggs, in 2 groups: 4 apparently unfertilized, 9 fertilized, 8 of which hatched.
18th. 8 eggs: 7 apparently unfertilized; 1 fertilized, but did not hatch. (Watched the female depositing some of these eggs.)
21st. 10 eggs: 9 apparently unfertilized; 1 fertilized, but did not hatch. (Watched the female depositing some of these eggs.)
25th. 10 eggs, in 2 groups: 8 apparently unfertilized, 2 hatched. (Watched the female depositing some of these eggs.)
30th. 16 eggs, in 3 separate groups: 15 apparently unfertilized, 1 hatched.

July
9th. 9 eggs, in 3 groups: all apparently unfertilized.
16th. The female died.

Total number of eggs deposited	120
„ „ apparently not fertilized	83
„ „ fertilized but failed to hatch	5
„ „ hatched	32

Record IV. Cage 38.—1912.

First Pair of F_1 Hybrids.

July
19th. 6.00 P.M. mating: continued to mate 15 hours.
28th. 5.00 A.M. ditto ditto 28 hours.

August
2nd. 31 eggs *, 30 hatched: 14 reared to the winged stage—(9 ♂ & 5 ♀).
3rd. 5.00 A.M. mating: continued to mate 16 hours.
4th. 17 eggs, all hatched: 13 reared to the winged stage—(5 ♂ & 8 ♀).
7th. 5.30 P.M. mating: continued to mate $15\frac{1}{2}$ hours
9th. 22 eggs, all hatched: 13 reared to the winged stage—(6 ♂ & 7 ♀).
12th. 28 eggs: 26 survived 1st moult: 18 reared to the winged stage—(9 ♂ & 9 ♀).

* Unless stated to the contrary, the eggs were deposited in one symmetrical group, which is typical of both *variolarius* and *servus*.

AUGUST

13th.	5.00 A.M. mating:	continued to mate	26 hours.	
17th.	9.00 P.M. ditto	ditto	14 hours.	

19th. 30 eggs (one group of 8 & one group of 22 eggs): killed 6 for cytological study. 14 reared to winged stage—(9 ♂ & 5 ♀).

19th.	6.00 P.M. mating:	continued to mate	26 hours.
21st.	7.30 P.M. ditto	ditto	2 hours.
22nd.	3.30 P.M. ditto	ditto	5 hours.
24th.	5.45 P.M. ditto	ditto	5 hours.
25th.	6.30 P.M. ditto	ditto	4 hours.
26th.	5.30 P.M. ditto	ditto	4½ hours.

27th. 21 eggs (at 10 A.M.): 18 survived 1st moult, 12 reared to winged stage—(3 ♂ & 9 ♀).

27th.	5.30 P.M. mating:	continued to mate	3 hours.
28th.	4.00 P.M. ditto	ditto	3½ hours.

JULY

30th. The male died and was preserved in glycerine (tube 34).

31st. 20 eggs (deposited on wire top of cage): 19 hatched, 12 reared to winged stage—(5 ♂ & 7 ♀).

SEPTEMBER

3rd. Killed the ♀ and preserved in glycerine. This female would undoubtedly have deposited more fertilized eggs, but at this period we had as many nymphs developing from all the hybrid pairs as we could properly care for, and were forced to be satisfied with the number of offspring already secured from this pair. The male was photographed, and is shown on Plate **28**, photo 9.

RECORD V. CAGE 39.—1912.

Second Pair of F_1 Hybrids.

JULY

19th.	9.00 P.M. mating:	continued to mate	13 hours.
30th.	5.00 P.M. ditto	ditto	16½ hours.

AUGUST

1st. 28 eggs. Discovered the ♀ sucking these eggs; she had taken the entire contents from 7 and probably more were injured, as only 11 hatched. 8 reared to winged stage—(5 ♂ & 3 ♀).

5th. 28 eggs, 17 hatched (6 survived 2nd moult). These were later caged w nymphs from eggs deposited August 12th.

6th. 6.00 P.M. mating: continued to mate 57 hours.

12th. 11 eggs, 3 hatched. These were later caged with nymphs from eggs deposited August 5th. 8 reared to winged stage—(4 ♂ & 4 ♀).

12th. 7.30 P.M. mating: continued to mate 12½ hours.

13th. 30 eggs, 24 hatched: 13 reared to winged stage—(5 ♂ & 8 ♀).

15th. 3.30 P.M. mating: continued to mate 15½ hours.

16th. 15 eggs, 12 hatched: 6 reared to winged stage—(4 ♂ & 2 ♀).

AUGUST.	
16th.	6.00 P.M. mating : continued to mate $9\frac{1}{2}$ hours.
19th.	6.00 P.M. ditto ditto 15 hours.
20th.	19 eggs, 15 hatched : 7 reared to winged stage—(6 ♂ & 1 ♀).
22nd.	7.30 P.M. mating : continued to mate $13\frac{1}{2}$ hours.
24th.	23 eggs, 15 hatched : 5 reared to winged stage—(3 ♂ & 2 ♀).
24th.	5.45 P.M. mating : continued to mate $9\frac{3}{4}$ hours.
25th.	2.00 P.M. ditto ditto $8\frac{1}{2}$ hours.
26th.	5.30 P.M. ditto ditto $4\frac{1}{2}$ hours.
27th.	5.30 P.M. ditto ditto 5 hours.
28th.	7.30 P.M. ditto ditto $6\frac{3}{4}$ hours.
30th.	8 eggs: 6 hatched (2 survived 2nd moult). These were later caged with nymphs from eggs deposited September 3rd and September 11th.
30th.	4.30 P.M. mating : continued to mate $4\frac{1}{2}$ hours.
31st.	3.45 P.M. ditto ditto $5\frac{1}{4}$ hours.
SEPTEMBER	
1st.	6.15 A.M. ditto ditto $2\frac{1}{4}$ hours.
1st.	9.00 P.M. ditto ditto $2\frac{1}{2}$ hours.
2nd.	4.45 P.M. ditto ditto $7\frac{1}{4}$ hours.
3rd.	7 eggs (4 survived 1st moult). These were later caged with nymphs from eggs deposited August 30th and September 11th.
3rd.	Noon, mating : continued to mate $3\frac{1}{2}$ hours.
3rd.	4.30 P.M. mating : continued to mate $5\frac{1}{2}$ hours.
4th.	3.00 P.M. ditto ditto 9 hours.
5th.	6.15 P.M. ditto ditto $2\frac{1}{4}$ hours.
8th.	7.30 P.M. ditto ditto $4\frac{1}{2}$ hours.
9th.	5.15 P.M. ditto ditto $1\frac{1}{4}$ hours.
11th.	15 eggs, 12 hatched (8 survived 2nd moult) : added these to nymphs from eggs deposited Aug. 30th & Sept. 3rd. 10 reared to winged stage—(4 ♂ & 6 ♀).
12th.	6.00 P.M. mating : continued to mate 11 hours.
16th.	The ♂ died : preserved in glycerine (tube 44). This male was photographed, and is shown on Plate **28**, photo 14.
21st.	Killed the ♀. Preserved in glycerine (tube 44).

RECORD VI. CAGE 40.—1912.

Third pair of F_1 Hybrids.

JULY	
24th.	5.00 A.M. mating : continued to mate $6\frac{1}{2}$ hours.
30th.	28 eggs, all hatched : 15 reared to the winged stage—(5 ♂ & 10 ♀).
31st.	5.00 A.M. mating : continued to mate 16 hours.
AUGUST	
1st.	28 eggs : 25 survived 1st moult ; 18 reared to winged stage—(11 ♂ & 7 ♀).
3rd.	28 eggs : 20 survived 1st moult ; 12 reared to winged stage—(6 ♂ & 6 ♀).
6th.	6.00 P.M. mating : continued to mate 17 hours.
11th.	7.30 P.M. ditto ditto 2 hours.
16th.	5.00 A.M. ditto ditto 2 hours.

AUGUST

16th. 10.00 A.M. 28 eggs, all hatched: 17 reared to winged stage—(10 ♂ & 7 ♀).
16th. 9.00 P.M. mating: continued to mate $6\frac{1}{2}$ hours.
17th. 3.45 P.M. ditto ditto $5\frac{3}{4}$ hours.
18th. 2.00 P.M. ditto ditto $7\frac{1}{2}$ hours.
19th. 6.00 P.M. ditto ditto $3\frac{1}{2}$ hours.
20th. 14 eggs. Killed 7 for cytological study; the remaining 7 hatched. Added 6 that survived the 2nd moult to nymphs from eggs deposited August 27th. Reared the 6 to winged stage.
20th. 7.30 P.M. mating: continued to mate 3 hours.
21st. 1.30 P.M. ditto ditto 8 hours.
22nd. 3.30 P.M. ditto ditto 8 hours.
24th. 5.45 P.M. ditto ditto $4\frac{3}{4}$ hours.
25th. 6.30 P.M. ditto ditto 4 hours.
26th. 17 eggs, 16 hatched: 6 reared to winged stage—(4 ♂ & 2 ♀).
26th. 5.30 P.M. mating: continued to mate 4 hours.
27th. 10 eggs, all hatched: 9 reared to winged stage; 15 in this cage including the 6 added from eggs deposited August 20th—(8 ♂ & 7 ♀).
27th. 3.30 P.M. mating: continued to mate $6\frac{1}{2}$ hours.
28th. 7.30 P.M. ditto ditto $5\frac{3}{4}$ hours.
29th. 5.15 P.M. ditto ditto $4\frac{1}{4}$ hours.
30th. 13 eggs, 12 hatched: 8 that survived were later caged with nymphs from eggs deposited September 7th.
30th. 4.00 P.M. mating: continued to mate 7 hours.

SEPTEMBER

2nd. 15 eggs, all hatched: 10 reared to winged stage—(6 ♂ & 4 ♀).
2nd. 4.45 P.M. mating: continued to mate $3\frac{3}{4}$ hours.
3rd. 8.00 P.M. ditto ditto 1 hour.
4th. The male died, and was preserved in glycerine (tube 38). This male is shown on Plate **28**, photo 10.
7th. 12 eggs, 11 hatched, and after the 2nd moult 8 nymphs were added from the eggs deposited August 30th. 17 reared to winged stage—(4 ♂ & 13 ♂).
7th. Killed the female and preserved in glycerine (tube 38). We were forced to kill this female, as at this period we had as many nymphs as we could properly care for.

RECORD VII. CAGE 41.—1912.

Fourth Pair of F_1 Hybrids.

JULY

28th. 6.00 P.M. mating: continued to mate $12\frac{1}{4}$ hours.

AUGUST

8th. 20 eggs, 15 hatched: 8 reared to winged stage—(4 ♂ & 4 ♀).
13th. 5.00 A.M. mating: continued to mate 31 hours.
17th. 25 eggs, 22 hatched: 13 reared to winged stage—(7 ♂ and 6 ♀).
22nd. 18 eggs, 15 hatched: 5 reared to winged stage—(1 ♂ & 4 ♀).
23rd. 3.30 P.M. mating: continued to mate 40 hours.
25th. 6.30 P.M. ditto ditto 17 hours.
27th. 26 eggs, 21 hatched: 9 reared to winged stage—(2 ♂ & 7 ♀).
27th. 5.30 P.M. mating: continued to mate $13\frac{1}{2}$ hours.

AUGUST

28th. 16 eggs, 13 survived 1st moult: These were later caged with nymphs from eggs deposited September 8th.

31st. 27 eggs, 23 survived 1st moult: 12 reared to winged stage—(4 ♂ & 8 ♀).

31st. 5.30 P.M. mating: continued to mate $11\frac{1}{2}$ hours.

SEPTEMBER

5th. 24 eggs, 16 survived 1st moult: 7 reared to winged stage—(4 ♂ & 3 ♀).

5th. 6.15 P.M. mating: continued to mate 49 hours.

8th. 14 eggs (7 killed for cytological study): 5 hatched; added these to nymphs from eggs deposited August 28th. (18 in all.) 9 reared to winged stage—(6 ♂ & 3 ♀).

8th. 2.30 P.M. mating: continued to mate $11\frac{1}{2}$ hours.

9th. 5.15 P.M. ditto : ditto 6 hours.

10th. 7.00 P.M. ditto : ditto 2 hours.

11th. Killed both ♂ and ♀, and preserved in glycerine (tube 42). The male is shown on Plate **28**, photo 12. We were forced to kill this pair, as we had as many nymphs in the laboratory as we could properly care for.

RECORD VIII. CAGE 44.—1912.

Fifth Pair of F_1 Hybrids.

AUGUST

6th. 2.00 P.M. mating: continued to mate 39 hours.

8th. 25 eggs, 2 hatched: none reared to winged stage.

9th. 5.00 P.M. mating: continued to mate 4 hours.

11th. 5.00 A.M. ditto ditto 1 hour.

14th. 13 eggs (1 group of 10 and 1 group of 3): 9 hatched, 7 survived 3rd moult. These were caged later with nymphs from eggs deposited August 20th.

15th. 6.00 P.M. mating: continued to mate 14 hours.

19th. 5.00 A.M. ditto ditto $4\frac{1}{2}$ hours.

20th. 13 eggs: 8 survived 1st moult, 4 survived 2nd moult. Added to nymphs from eggs deposited August 14th. 8 reared to winged stage—(1 ♂ & 7 ♀).

23rd. 3.30 P.M. mating: continued to mate 16 hours.

27th. 30 eggs: one hatched. Did not rear.

27th. 7.30 P.M. mating: continued to mate $14\frac{1}{2}$ hours.

28th. 7.30 P.M. ditto ditto $9\frac{3}{4}$ hours.

29th. 15 eggs: 11 survived 1st moult, 4 survived 3rd moult. These were later caged with nymphs from eggs deposited September 3rd.

SEPTEMBER

1st. 9.00 P.M. mating: continued to mate 7 hours.

2nd. 4.45 P.M. ditto ditto $7\frac{1}{4}$ hours.

3rd. 14 eggs, 8 hatched: 5 survived 2nd moult, added these to nymphs from eggs deposited August 29th; 8 reared to winged stage—(3 ♂ & 5 ♀).

3rd. Killed both the ♂ & ♀, and preserved them in glycerine (tube 37). The male is shown on Plate **28**, photo 11.

We killed this pair because the small percentage of eggs that had hatched indicated that these bugs were not functioning normally.

Record IX. Cage 46.—1912.

Sixth Pair of F_1 Hybrids.

(This ♀ and the ♀ of Cage 48 were fertilized by the same ♂.)

August
15th. 3.30 P.M. mating: continued to mate 15½ hours.
22nd. 21 eggs, 6 hatched (only 2 survived the 1st moult): later added these to nymphs from eggs deposited August 27th.
27th. 9 eggs, all hatched: added these to nymphs from eggs deposited August 22nd. 5 reared to winged stage—(2 ♂ & 3 ♀).
27th. 7.30 P.M. mating: continued to mate 3 hours.
29th. 14 eggs, 1 hatched and died after 1st moult.
29th. 5.15 P.M. mating: continued to mate 4¼ hours.

September
3rd. 14 eggs. All fertilized, but none hatched.
3rd. 2.30 P.M. mating: continued to mate 7½ hours.
4th. 12 eggs: 7 fertilized, but none hatched.
4th. 3.00 P.M. mating: continued to mate 6 hours.
5th. 6.15 P.M. ditto ditto 1¼ hours.
8th. 19 eggs, 5 hatched. Later added these to nymphs from eggs deposited September 11th and September 14th.
11th. 11 eggs, 10 hatched, 8 survived first moult. Added these to nymphs from eggs deposited September 8th and September 14th.
11th. 5.45 P.M. mating: continued to mate 5¾ hours.
12th. 6.00 P.M. ditto ditto 4 hours.
13th. 6.00 P.M. ditto ditto 2½ hours.
14th. 14 eggs, nearly all fertilized, 3 hatched. Added these to nymphs from eggs deposited September 8th and September 11th. 8 reared to winged stage—(5 ♂ & 3 ♀).
17th. 12 eggs: 11 fertilized, but none hatched.
17th. 12.45 P.M. mating: continued to mate 7¾ hours.
18th. 8·00 P.M. ditto ditto 5½ hours.
19th. 8 eggs: 4 fertilized, none hatched.
19th. Killed the male and preserved in glycerine (tube 49). This male was photographed, and is shown on Plate **28**, photo 13.
21st. Killed the female and preserved in glycerine (tube 49).

Record X. Cage 48.—1912.

Seventh Pair of F_1 Hybrids.

(This ♀ and the ♀ of Cage 46 were fertilized by the same ♂.)

August
16th. 9.00 P.M. mating: continued to mate 8 hours.
19th. 5.00 A.M. ditto ditto 5 hours.
20th. 21 eggs, 20 hatched: 15 reared to winged stage—(6 ♂ & 9 ♀).
22nd. 15 eggs: 13 survived first moult. 10 reared to winged stage—(4 ♂ & 6 ♀).

August

26th. 5.00 A.M., 28 eggs (one group of 16 and one group of 12): 26 hatched, 14 reared to winged stage—(3 ♂ & 11 ♀).

26th. 5.30 A.M. mating: continued to mate $16\frac{1}{2}$ hours.

28th. 14 eggs, 4 hatched. These were caged later with nymphs from eggs deposited August 31st.

31st. 14 eggs, 14 hatched. Added these to nymphs from eggs deposited August 28th. 12 reared to winged stage—(10 ♂ & 2 ♀).

31st. 3.30 P.M. mating: continued to mate $9\frac{3}{4}$ hours.

September

1st. 9.00 P.M. ditto ditto 8 hours.

2nd. 14 eggs, 13 hatched. 9 reared to winged stage—(6 ♂ & 3 ♀).

2nd. 4.45 P.M. mating: continued to mate $3\frac{1}{4}$ hours.

5th. 10 eggs, all hatched. These were caged later with nymphs from eggs deposited September 8th.

7th. 4.30 P.M. mating: continued to mate 3 hours.

8th. 4 eggs, all hatched. Added these to nymphs from eggs deposited September 5th. 8 reared to winged stage—(5 ♂ & 3 ♀).

8th. 7.30 P.M. mating: continued to mate 2 hours.

17th. Killed the female, as she had not mated nor deposited eggs for 9 days: preserved in glycerine (tube 46). The male is shown on Plate **28**, photo 13.

Record XI. Cage 50.—1912.

One Pair F_1 Hybrid ♀ × Pure *variolarius* ♂.

August

22nd. 7.30 p.m. mating: continued to mate 13 hours.

25th. 9 eggs: 7 developed, but failed to hatch.

27th. 11 eggs: all developed, 2 hatched. After second moult, these were caged with nymphs from eggs deposited September 2nd and September 3rd.

28th. 15 eggs: 13 developed, but none hatched.

30th. 14 eggs, 10 hatched. 9 reared to winged stage—(7 ♂ & 2 ♀).

September

2nd. 6 eggs, 5 developed, but only 1 hatched. After first moult, this was caged with nymphs from eggs deposited August 27th and September 3rd.

3rd. 8 eggs, all developed, 3 hatched. Added these, after first moult, to nymphs from eggs deposited August 27th and September 2nd. 4 reared to winged stage—(3 ♂ & 1 ♀).

4th. 13 eggs, 5 hatched. These were caged later with nymphs from eggs deposited September 16th and September 18th.

8th. 11 eggs, all hatched: 7 reared to winged stage—(3 ♂ & 4 ♀).

11th. 14 eggs, 13 developed, but none hatched.

13th. 4 eggs, all developed, but none hatched.

16th. 10 eggs, 9 developed, 2 hatched. Added these later to nymphs from eggs deposited September 4th and 18th.

18th. 4 eggs, 2 hatched. Added these, after second moult, to nymphs from eggs deposited September 4th and September 16th. 6 reared to winged stage—(5 ♂ & 1 ♀).

Both parents killed and preserved in glycerine (tube 47). The male was photographed, and is shown on Plate **34**, photo 58.

References.

CASTLE, W. E.

1911. "Heredity in Relation to Evolution and Animal Breeding." D. Appleton & Company.

1912. "The Inconstancy of Unit-characters." Amer. Nat., vol. xlvi.

FOOT, K., & E. C. STROBELL.

1913. "Preliminary Note on the Results of Crossing two Hemipterous Species with Reference to the Inheritance of an Exclusively Male Character, and its Bearing on Modern Chromosome Theories." Biol. Bull., vol. xxiv. No. 3.

PUNNETT, R. C.

1911. "Mendelism." The Macmillan Company.

EXPLANATION OF THE PLATES.

All the photographs are of male specimens. In all cases only the ventral surface of the bugs is shown.

The two bugs of photo 1 are dried specimens. Those of photos 2 to 66 are preserved in glycerine *. The specimens are placed serially in a small test-tube which is filled with pure glycerine and hermetically sealed. The genital segment of each bug has been pulled out and cotton inserted behind the segment to hold it in position to show the entire ventral surface.

The magnification is about $1\frac{1}{2}$ diameters: this varies slightly because the work was done by two photographers, and they did not give exactly the same enlargement. The reproductions are bromide prints made directly from large negatives of the original plates; the individual photographs of which these plates were composed being sunprints from the original negatives.

PLATE 28.

PHOTO 1. Male specimens of *Euschistus variolarius* and *Euschistus servus.* On the left is *E. variolarius,* showing the ventral surface and the clearly defined black spot, always present on the genital segment of the males of this species. On the right is *E. servus,* showing the ventral surface and the genital segment without any trace of the black spot typical of *variolarius.*

PHOTO 2. Seven male specimens of *E. variolarius,* showing the typical black spot on the genital segment. These specimens are from the first generation of 1912. The parent bugs were of the first generation of 1911, which were kept in captivity through the winter of 1911–12.

PHOTO 3. Five male specimens of *E. servus* received from North Carolina in the fall of 1912.

PHOTO 4. The wild *E. servus* male that fertilized the *E. variolarius* female.

PHOTO 5. Three of the five *E. servus* males that were caged all winter with *E. variolarius* females: *see* page 342.

---

* We are indebted to Prof. Ralph Tower, of the Museum of Natural History of New York, for suggesting the use of glycerine as a preservative.

PHOTO 6. One of the two male *E. variolarius* from the same deposition of eggs from which we raised the three females for crossing with *E. servus*: *see* page 342.

PHOTO 7. Two male specimens of the F_1 hybrid generation. These bugs were killed August 11th, 1912, and their testes dissected out and mounted for cytological study.

PHOTO 8. Two male specimens of the F_1 hybrid generation. Killed August 28th, 1912.

PHOTO 9. The male of the first pair of F_1 hybrids. The F_2 males from this pair of hybrids are shown on Plate **29**, photos 17–25. *See* Record IV. and page 346.

PHOTO 10. The male of the third pair of F_1 hybrids. The F_2 males from this pair of hybrids are shown on Plate **31**, photos 33–41. *See* Record VI. and page 347.

PHOTO 11. The male of the fifth pair of F_1 hybrids. The F_2 males from this pair of hybrids are shown on Plate **28**, photos 15 and 16. *See* Record VIII. and page 347.

PHOTO 12. The male of the fourth pair of F_1 hybrids. The F_2 males from this pair of hybrids are shown on Plate **32**, photos 42–48. *See* Record VII. and page 347.

PHOTO 13. The male of the sixth and seventh pairs of F_1 hybrids. The F_2 males from the sixth pair are shown on Plate **32**, photos 49 & 50, and the F_2 males from the seventh pair are shown on Plate **33**, photos 51–57. *See* Records IX. and X. and page 349.

PHOTO 14. The male of the second pair of F_1 hybrids. The F_2 males from this pair are shown on Plate **30**, photos 26–32. *See* Record V. and page 346.

PHOTOS 15–16. Four F_2 males from the fifth pair of F_1 hybrids. *See* photo 11 for the male of this pair of hybrids, Record VIII. and page 347.

PLATE 29.

PHOTOS 17–25. Forty-three F_2 males from the first pair of F_1 hybrids. *See* photo 9, Plate **28**, for the male of this pair of hybrids, Record IV. and page 346.

PLATE 30.

PHOTOS 26–32. Thirty F_2 males from the second pair of F_1 hybrids. *See* photo 14, Plate **28**, for the male of this pair of F_1 hybrids, Record V. and page 346.

PLATE 31.

PHOTOS 33–41. Forty-eight F_2 males from the third pair of F_1 hybrids. *See* photo 10, Plate **28**, for the male of this pair of hybrids, Record VI. and page 347.

PLATE 32.

PHOTOS 42–48. Twenty-seven F_2 males from the fourth pair of F_1 hybrids. *See* photo 12, Plate **28**, for the male of this pair of hybrids, Record VII. and page 347.

PHOTOS 49–50. Six F_2 males from the sixth pair of F_1 hybrids. *See* photo 13, Plate **28**, for the male of this pair of hybrids, Record IX. and page 349.

PLATE 33.

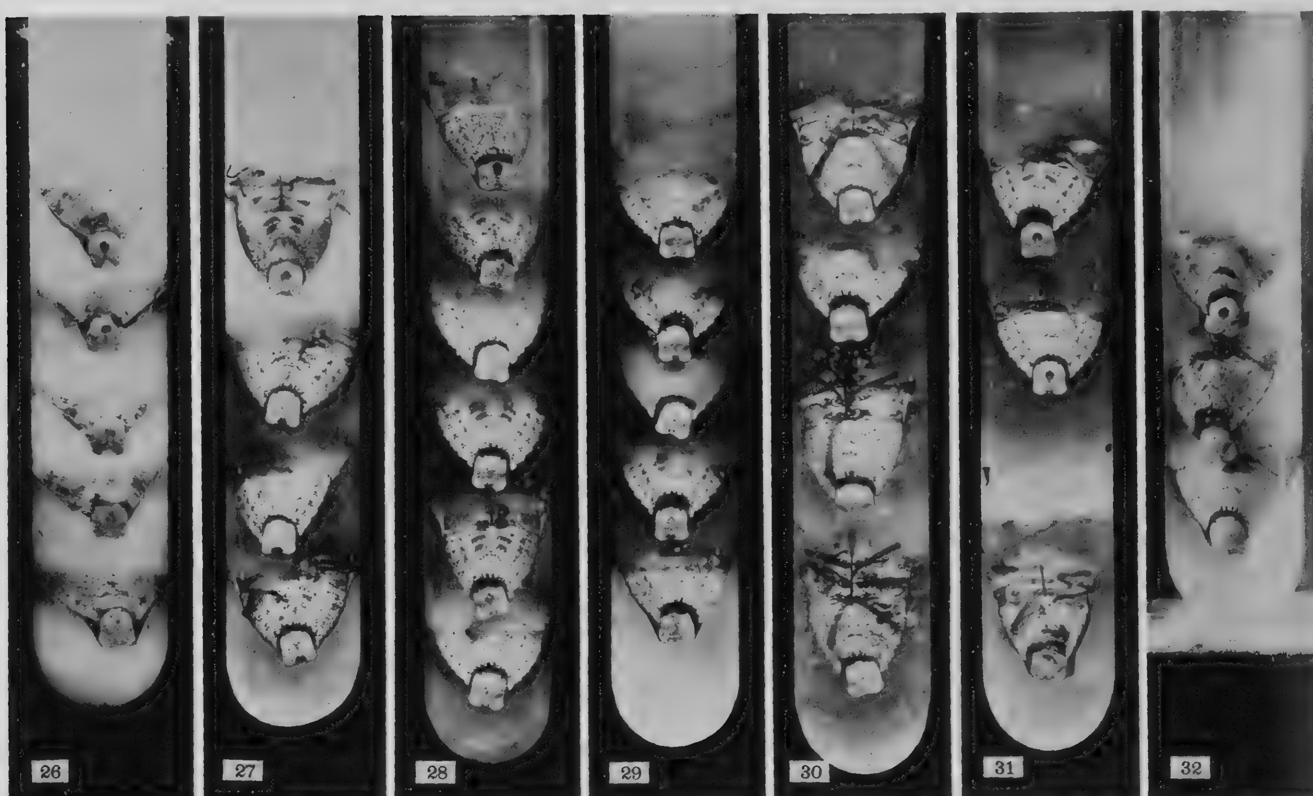
PHOTOS 51–57. Thirty-two F_2 males from the seventh pair of F_1 hybrids. *See* photo 13, Plate **28**, for the male of this pair of hybrids, Record X. and page 349.

Anglo Engraving Co.

EUSCHISTUS VARIOLARIUS, E. SERVUS & HYBRIDS.

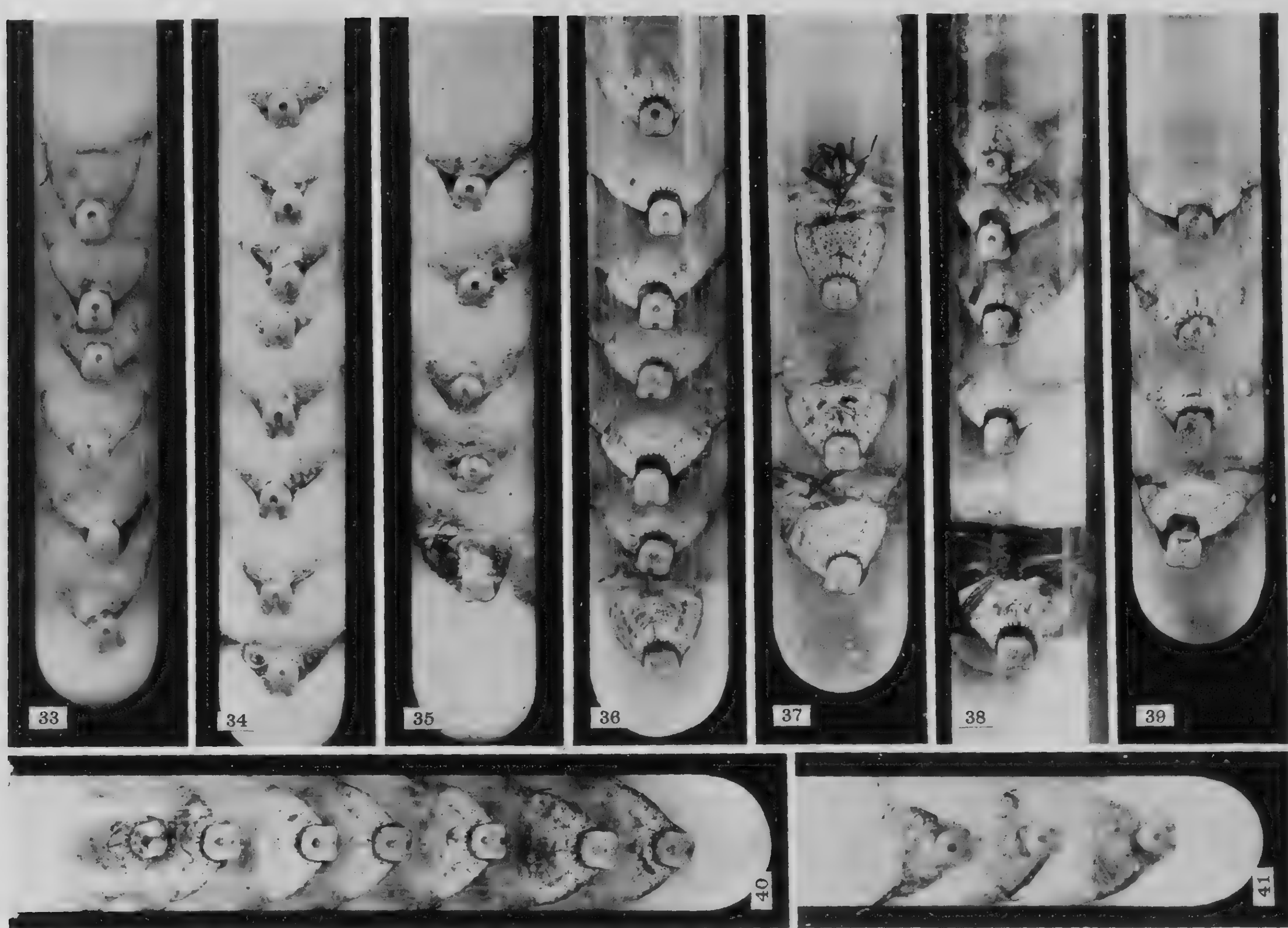
Anglo Engraving Co

F2 HYBRIDS from E. VARIOLARIUS & E. SERVUS.



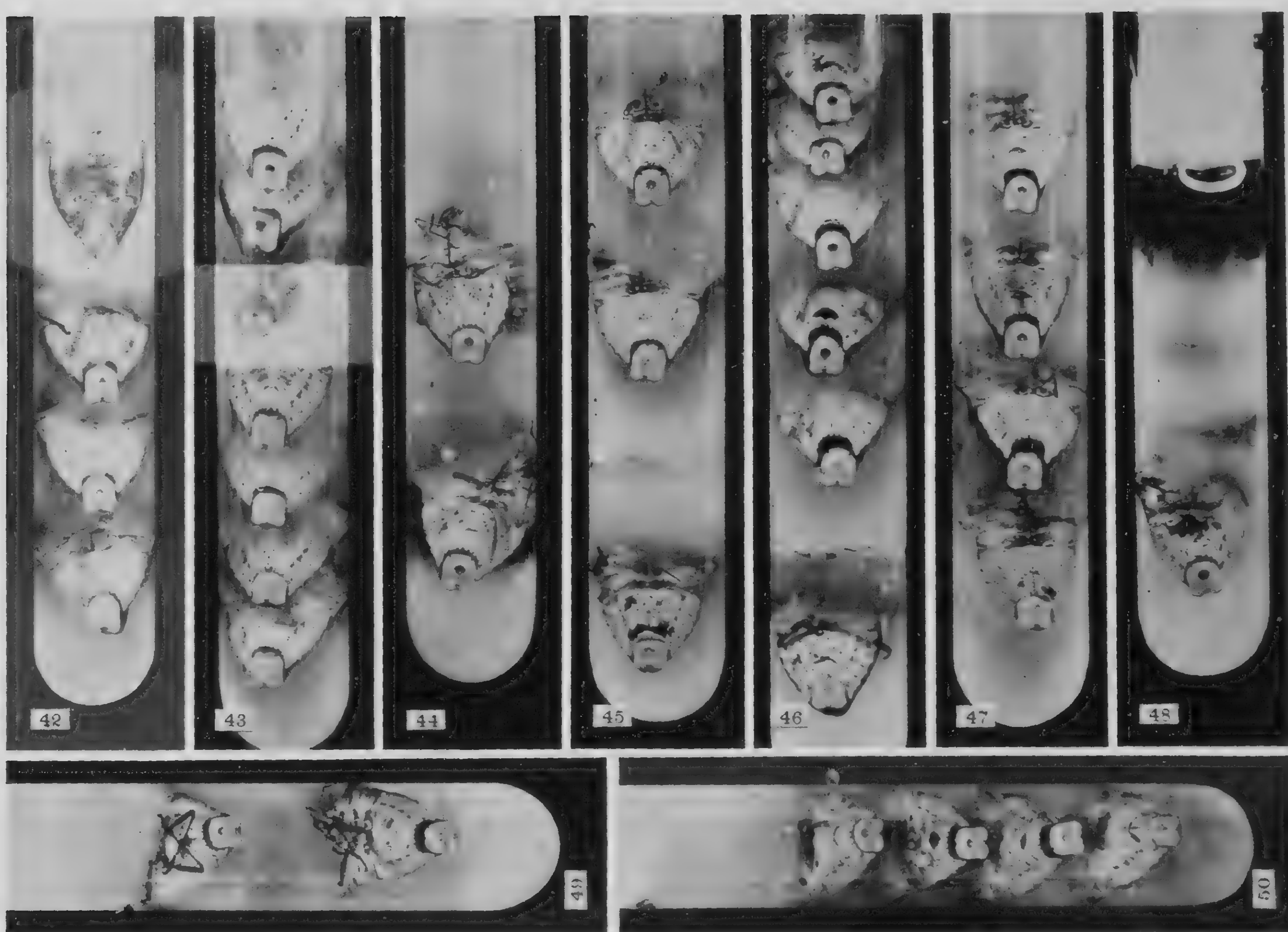
Anglo Engraving Co.

F2 HYBRIDS from E. VARIOLARIUS & E. SERVUS.



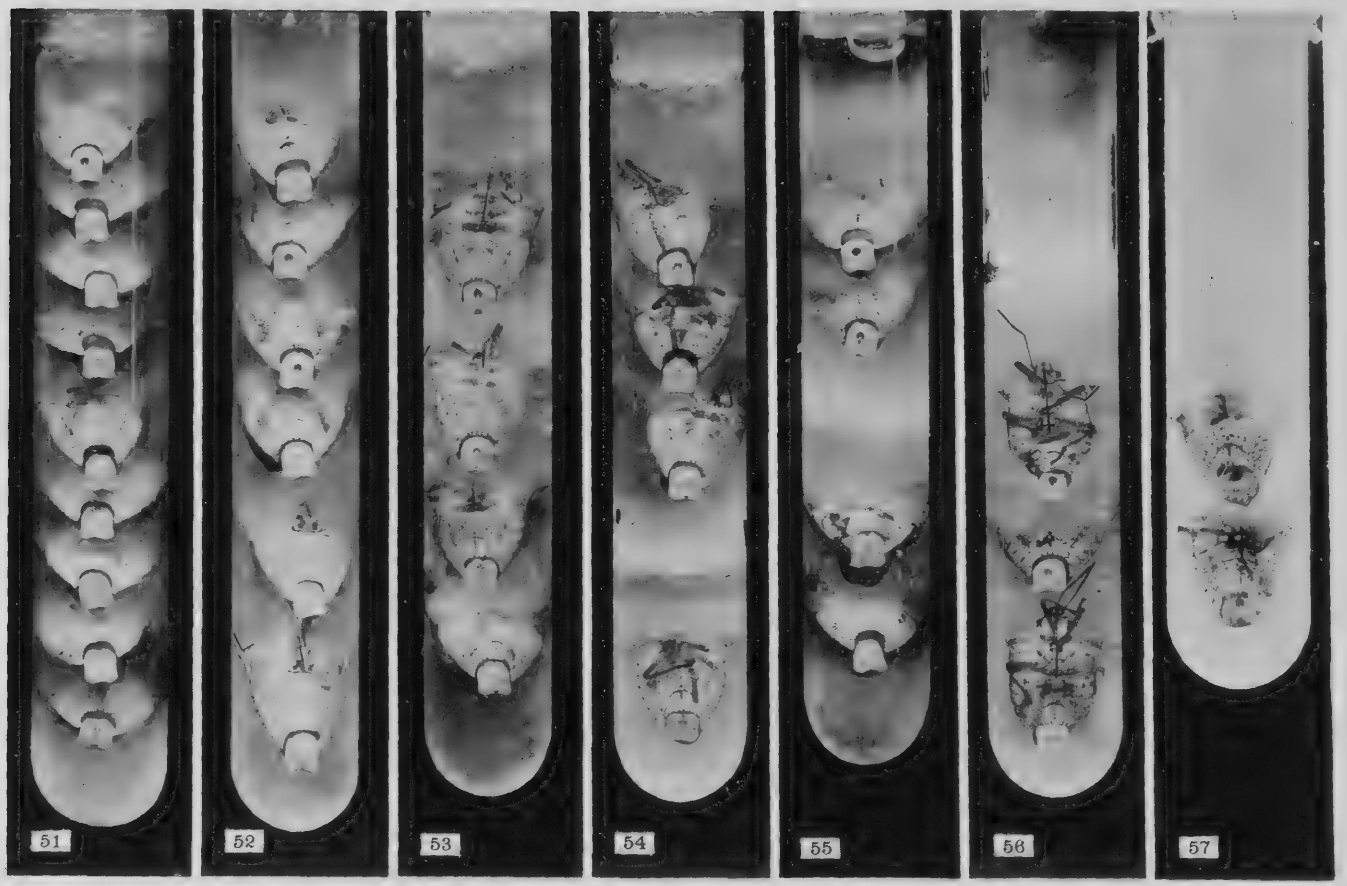
Anglo Engraving Co.

F2 HYBRIDS from E. VARIOLARIUS & E. SERVUS.



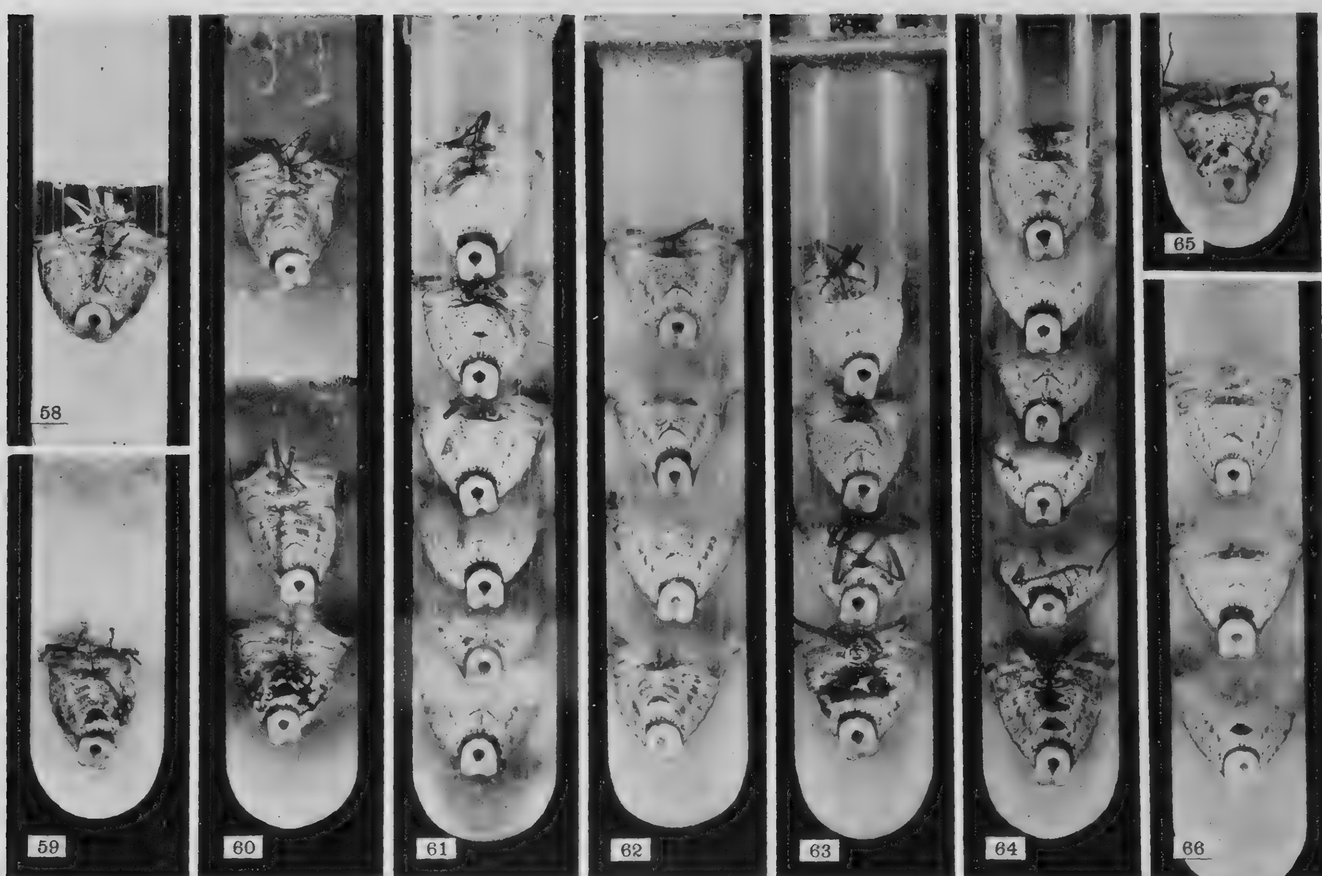
Anglo Engraving Co.

F2 HYBRIDS from E. VARIOLARIUS & E. SERVUS.



Anglo Engraving Co.

F2 HYBRIDS from E. VARIOLARIUS & E. SERVUS.



Anglo Engraving Co.

E. VARIOLARIUS MALES & MALES from F_1 ♀ X E. VARIOLARIUS ♂

PLATE 34.

PHOTO 58. The pure male *variolarius* that was raised in the laboratory in 1912, and the same season fertilized both a pure female *variolarius* and the F_1 hybrid female of Record XI., and pages 345, 353.

PHOTOS 59–61. Ten males from the above mentioned pair of pure *variolarius*. *See* photo 58 for the male of this pair.

PHOTOS 62–66. Eighteen males from the above mentioned F_1 hybrid female, fertilized by the pure *variolarius* male of photo 58, Record XI. and pages 345, 352–3.

[*Extracted from the* Linnean Society's Journal—Zoology, vol. xxxii. *September* 1915.]

Results of Crossing two Hemipterous Species, with reference to the Inheritance of two Exclusively Male Characters. By Katharine Foot and E. C. Strobell. (Communicated by Prof. E. B. Poulton, F.R.S., Pres.L.S.)

(Plates **41–47**.)

[Read 3rd June, 1915.]

The results given in this paper are due to the interesting discovery made by Dr. Eltringham of Oxford, that there is a marked difference in the length of the intromittent organ of the two hemipterous species *Euschistus variolarius* and *Euschistus servus*.

We feel greatly indebted to Professor Poulton for kindly suggesting Dr. Eltringham to us, in response to our expressed wish to find an experienced entomologist in England who would be willing to study *E. variolarius* and *E. servus* with a view of discovering some marked character distinctive of each species that could be profitably studied in the hybrids.

The result of Dr. Eltringham's investigations is of special satisfaction to us, because the discovery of a difference in the length of the intromittent organ of the two species offers a valuable control for the results obtained and the conclusions we were able to draw from our study of the transmission of the genital spot *, enabling us to compare the inheritance of these two exclusively male characters *in the same insect*.

During our experimental work on the genital spot (Foot and Strobell, '13 & '14) we carefully isolated and preserved each insect, in the hope that future investigation by an experienced entomologist might reveal some other marked character in these insects that would enable us to determine what relation, if any, might exist between the inheritance of a second definite character and the inheritance of the genital spot in each hybrid.

Having our material preserved in this way has made it possible for us to demonstrate both the exact appearance of the genital spot and the exact length of the intromittent organ *in one and the same individual* of the F_1 and F_2 hybrids, and also of the offspring from the backcross. We have made this comparison very simple by placing the photographs of the intromittent organs demonstrated in this paper in exactly the same order in which the photographs of the insects themselves were placed in our paper on the

* This is a distinct black spot which is present on the genital segment of the males of *Euschistus variolarius*, and is a distinguishing feature of this species, while it is absent in *E. servus*. It is the presence of this exclusively male character which led us to cross these two species, with the hope of putting to an experimental test the chromosome-theory of sex-determination (Foot and Strobell, '13 & '14).

inheritance of the genital spot, which is published in this same volume (Plates **28–34**). It is only necessary to compare the two sets of photographs in order to determine whether any definite relation exists in the inheritance of these two exclusively male characters. Such a comparison proves conclusively that the two are not linked in inheritance (see Linkage, p. 475).

The study of the genital spot in these hybrids (Foot and Strobell, '13 & '14) forced certain conclusions as to its bearing on recent chromosome-theories of heredity, and also its bearing on Mendel's law of heredity. We shall demonstrate in the following paper that the results obtained from the study of the genital spot are in fact duplicated in the case of the intromittent organ—the study of this second exclusively male character supporting *in every detail* the conclusions forced by the facts of inheritance of the genital spot.

Results and Discussion.

We have dissected the intromittent organs from the genital segment of many of the parent species and from all the hybrids both of the F_1 and F_2 generations, and also from the offspring of the backcross. After mounting, the intromittent organs were photographed at a magnification of 20 diameters, and all the measurements were carefully made from these photographs ; therefore all the recorded lengths of the intromittent organs must be reduced to one-twentieth to obtain the actual lengths.

The intromittent organ of *Euschistus variolarius* (at a magnification of 20 diameters) varies in length between 85·5 mm. and 106 mm., while that of *Euschistus servus* varies between 146 mm. and 182 mm. These measurements were made from 62 pure *variolarius* specimens, and from 62 pure *servus* specimens.

The following tables give the measurements of the photographs of the intromittent organs (arranged in order of length) of the parent species, of hybrids, and of the backcross.

Table 1 gives the lengths of the intromittent organs from 62 specimens of *Euschistus variolarius*, and shows those cases in which 2 or more specimens have the same length.

Table 2 gives the lengths of the 62 intromittent organs from *Euschistus servus*.

Tables 3 to 11 show the lengths of the intromittent organs from all the F_2 hybrids and from the offspring of the backcross. These tables also show to what degree the genital spot is inherited by each hybrid, and they therefore demonstrate what relation, if any, exists in the inheritance of these two exclusively male characters. Tables 3 to 9 inclusive give the lengths of the intromittent organs for each family of the 7 pairs of F_1 hybrids ; and the mean length of the intromittent organ is computed for each separate family as well as for the total number of F_2 hybrids.

TABLE 1.

Lengths of intromittent organs from 62 specimens of *Euschistus variolarius*. × 20 diams.

$85\frac{1}{2}$ mm.	1
87 mm.	1
88 mm.	1
89 mm.	1
90 mm.	1
91 mm.	1
92 mm.	2
93 mm.	4
$93\frac{1}{2}$ mm.	1
94 mm.	6
$94\frac{1}{2}$ mm.	2
95 mm.	1
$95\frac{1}{2}$ mm.	2
96 mm.	7
$96\frac{1}{2}$ mm.	1
97 mm.	1
$97\frac{1}{2}$ mm.	1
98 mm.	6
$98\frac{1}{2}$ mm.	1
99 mm.	2
100 mm.	7
$100\frac{1}{2}$ mm.	1
101 mm.	4
102 mm.	3
104 mm.	1
$104\frac{1}{2}$ mm.	2
106 mm.	1
5,996	62

Mean length = 96·70 mm.

TABLE 2.

Lengths of intromittent organs from 62 specimens of *Euschistus servus*. × 20 diams.

146 mm.	1
152 mm.	1
154 mm.	1
158 mm.	2
$158\frac{1}{2}$ mm.	1
160 mm.	1
$160\frac{1}{2}$ mm.	2
161 mm.	1
162 mm.	4
$162\frac{1}{2}$ mm.	3
$163\frac{1}{2}$ mm.	2
164 mm.	4
$164\frac{1}{2}$ mm.	2
165 mm.	1
$165\frac{1}{2}$ mm.	1
166 mm.	8
$166\frac{1}{2}$ mm.	1
167 mm.	3
$167\frac{1}{2}$ mm.	1
168 mm.	1
169 mm.	1
$169\frac{1}{2}$ mm.	1
170 mm.	4
$170\frac{1}{2}$ mm.	1
171 mm.	1
172 mm.	1
$172\frac{1}{2}$ mm.	1
173 mm.	2
174 mm.	1
$174\frac{1}{2}$ mm.	1
175 mm.	1
$175\frac{1}{2}$ mm.	1
176 mm.	1
$176\frac{1}{2}$ mm.	1
177 mm.	1
$179\frac{1}{2}$ mm.	1
182 mm.	1
10,318	62

Mean length = 166·41 mm.

TABLES 3 TO 10.

Lengths of the intromittent organs in the F_2 hybrids, showing the influence of the two original parent species, and a comparison of these lengths with the inheritance of the *E. variolarius* genital spot. This comparison demonstrates that these two exclusively male characters are not linked in inheritance.

TABLE 3.—F_2 males from the 1st pair of F_1 hybrids. Plate **42**. 43 specimens.

Photos.	*Genital spot.**		*Intromittent organ.*	× 20 diams.
17	1st (upper) bug	intermediate.	*E. variolarius*	96 mm.
	2nd ,,	ditto.	*E. servus*	146 ,,
	3rd ,,	ditto.	Intermediate	130 ,,
	4th ,,	*E. servus.*	ditto	136 ,,
	5th ,,	intermediate.	*E. servus*	150 ,,
18	1st (upper) bug	intermediate.	Intermediate	112½ mm.
	2nd ,,	ditto.	ditto	128 ,,
	3rd ,,	ditto.	ditto	122 ,,
	4th ,,	ditto.	ditto	137 ,,
	5th ,,	*E. servus.*	*E. servus*	148 ,,
19	1st (upper) bug	intermediate.	Intermediate	114 mm.
	2nd ,,	ditto.	ditto	129 ,,
	3rd ,,	*E. servus.*	ditto	139½ ,,
	4th ,,	ditto.	ditto	144 ,,
20	1st (upper) bug	*E. servus.*	Intermediate	130 mm.
	2nd ,,	ditto.	ditto	120 ,,
	3rd ,,	ditto.	*E. variolarius*	98 ,,
21	1st (upper) bug	intermediate.	Intermediate	124 mm.
	2nd ,,	*E. servus.*	*E. servus*	152 ,,
	3rd ,,	ditto.	Intermediate	133 ,,
	4th ,,	ditto.	ditto	122 ,,
	5th ,,	ditto.	ditto	136 ,,
	6th ,,	ditto.	*E. variolarius*	97 ,,
22	1st (upper) bug	*E. servus.*	Intermediate	136 mm.
	2nd ,,	ditto.	*E. servus*	146 ,,
	3rd ,,	ditto.	Intermediate	124 ,,
	4th ,,	ditto.	ditto	128½ ,,
	5th ,,	ditto.	ditto	130 ,,
23	1st (upper) bug	*E. variolarius.*	*E. variolarius*	98 mm.
	2nd ,,	*E. servus.*	Intermediate	120 ,,
	3rd ,,	ditto.	*E. variolarius*	104 ,,
	4th ,,	ditto.	Intermediate	122 ,,

* The genital segment of these insects is demonstrated in Plates **28–34** of this volume, the number of the photographs being the same for the two papers, thus admitting an accurate comparison of the inheritance of the genital spot and the type of intromittent organ. In classifying the photographs of these hybrids we included under the *servus* type not only those specimens with no spot whatever, but also those with merely a faint indication of a spot, for the latter was not visible in the living specimens nor in those freshly killed. Such a faint indication of a spot will probably not show in all the prints.

Photos.	Genital spot.		Intromittent organ.	× 20 diams.
24	1st (upper) bug	intermediate.	*E. variolarius*	100 mm.
	2nd ,,	*E. servus.*	Intermediate	114 ,,
	3rd ,,	ditto.	ditto	132½ ,,
25	1st (upper) bug	intermediate.	Intermediate	114½ mm.
	2nd ,,	ditto.	ditto	123 ,,
	3rd ,,	ditto.	*E. variolarius*	100 ,,
	4th ,,	ditto.	Intermediate	108 ,,
	5th ,,	ditto.	*E. variolarius*	93 ,,
	6th ,,	*E. servus.*	Intermediate	132 ,,
	7th ,,	ditto.	*E. variolarius*	85½ ,,
	8th ,,	ditto.	Intermediate	140 ,,

Mean length of intromittent organ, 123·14 mm.

TABLE 4.—F_2 males from the second pair of F_1 hybrids. Plate **43**. 30 specimens.

Photos.	Genital spot.		Intromittent organ.	× 20 diams.
26	1st (upper) bug	*E. variolarius.*	Intermediate	115½ mm.
	2nd ,,	intermediate.	*E. variolarius*	100 ,,
	3rd ,,	ditto.	Intermediate	116 ,,
	4th ,,	ditto.	ditto	118 ,,
	5th ,,	ditto.	ditto	118 ,,
27	1st (upper) bug	intermediate.	*E. variolarius*	99 mm.
	2nd ,,	*E. servus.*	Intermediate	130 ,,
	3rd ,,	ditto.	ditto	130 ,,
	4th ,,	ditto.	ditto	130 ,,
28	1st (upper) bug	*E. variolarius.*	*E. variolarius*	90 mm.
	2nd ,,	intermediate.	Intermediate	142 ,,
	3rd ,,	*E. servus.*	ditto	124 ,,
	4th ,,	ditto.	ditto	131 ,,
	5th ,,	intermediate.	ditto	121 ,,
	6th ,,	*E. servus.*	ditto	127½ ,,
29	1st (upper) bug	*E. servus.*	Intermediate	124 mm.
	2nd ,,	ditto.	ditto	123 ,,
	3rd ,,	ditto.	ditto	125 ,,
	4th ,,	intermediate.	ditto	126 ,,
	5th ,,	*E. servus.*	ditto	126 ,,
30	1st (upper) bug	*E. servus.*	Intermediate	130 mm.
	2nd ,,	ditto.	ditto	134½ ,,
	3rd ,,	ditto.	ditto	115½ ,,
	4th ,,	ditto.	ditto	133 ,,
31	1st (upper) bug	intermediate.	Intermediate	114 mm.
	2nd ,,	ditto.	ditto	114 ,,
	3rd ,,	ditto.	*E. variolarius*	99½ ,,
32	1st (upper) bug	*E. variolarius.*	Intermediate	114½ mm.
	2nd ,,	intermediate.	ditto	122 ,,
	3rd ,,	*E. servus.*	ditto	127 ,,

Mean length of intromittent organ, 120·67 mm.

TABLE 5.—F_2 males from the third pair of F_1 hybrids. Plate **44**.
48 specimens.

Photos.	*Genital spot.*		*Intromittent organ.*	× 20 diams.
33	1st (upper) bug	intermediate.	Intermediate	117½ mm.
	2nd ,,	ditto.	ditto	124 ,,
	3rd ,,	ditto.	ditto	116½ ,,
	4th ,,	ditto.	ditto	144 ,,
	5th ,,	*E. servus.*	ditto	123½ ,,
	6th ,,	intermediate.	ditto	130 ,,
34	1st (upper) bug	*E. variolarius.*	Intermediate	128 mm.
	2nd ,,	intermediate.	ditto	131 ,,
	3rd ,,	ditto.	ditto	140 ,,
	4th ,,	*E. servus.*	ditto	130 ,,
	5th ,,	*E. variolarius.*	ditto	140 ,,
	6th ,,	ditto.	ditto	121 ,,
	7th ,,	intermediate.	ditto	123 ,,
	8th ,,	ditto.	*E. servus*	147 ,,
35	1st (upper) bug	*E. variolarius.*	*E. variolarius*	104 mm.
	2nd ,,	ditto.	Intermediate	115 ,,
	3rd ,,	intermediate.	ditto	126 ,,
	4th ,,	ditto.	ditto	134 ,,
	5th ,,	*E. servus.*	ditto	134½ ,,
36	1st (upper) bug	*E. variolarius.*	Intermediate	114 mm.
	2nd ,,	intermediate.	ditto	127½ ,,
	3rd ,,	ditto.	ditto	127½ ,,
	4th ,,	*E. servus.*	ditto	124 ,,
	5th ,,	ditto.	ditto	142 ,,
	6th ,,	ditto.	ditto	120 ,,
	7th ,,	ditto.	ditto	127½ ,,
37	1st (upper) bug	*E. servus.*	Intermediate	122½ mm.
	2nd ,,	intermediate.	ditto	122½ ,,
	3rd ,,	*E. servus.*	ditto	126 ,,
38	1st (upper) bug	intermediate.	Intermediate	112 mm.
	2nd ,,	ditto.	ditto	120 ,,
	3rd ,,	ditto.	ditto	126 ,,
	4th ,,	*E. servus.*	ditto	139½ ,,
	5th ,,	ditto.	ditto	140 ,,
39	1st (upper) bug	intermediate.	Intermediate	137 mm.
	2nd ,,	ditto.	ditto	134½ ,,
	3rd ,,	*E. servus.*	ditto	140 ,,
	4th ,,	ditto.	ditto	124 ,,
40	1st (upper) bug	*E. variolarius.*	Intermediate	114½ mm.
	2nd ,,	intermediate.	ditto	117 ,,
	3rd ,,	ditto.	ditto	122 ,,
	4th ,,	ditto.	ditto	136½ ,,
	5th ,,	ditto.	ditto	126 ,,
	6th ,,	ditto.	ditto	126½ ,,
	7th ,,	ditto.	ditto	120 ,,
41	1st (upper) bug	*E. variolarius.*	Intermediate	116½ mm.
	2nd ,,	intermediate.	ditto	132 ,,
	3rd ,,	ditto.	ditto	126 ,,

Mean length of intromittent organ, 126·92 mm.

Table 6.—F_2 males from the fourth pair of F_1 hybrids. Plate **45.** 27 specimens.

Photos.	*Genital spot.*	*Intromittent organ.*	× 20 diams.
42	1st (upper) bug intermediate.	Intermediate	142 mm.
	2nd „ ditto.	ditto	130 „
	3rd „ ditto.	ditto	130½ „
	4th „ *E. servus.*	ditto	136 „
43	1st (upper) bug intermediate.	Intermediate	118½ mm.
	2nd „ ditto.	ditto	132 „
	3rd „ ditto.	ditto	140 „
	4th „ *E. servus.*	ditto	133 „
	5th „ ditto.	ditto	127 „
	6th „ ditto.	ditto	138 „
	7th „ ditto.	ditto	141½ „
44	1st (upper) bug intermediate.	Intermediate	115 mm.
	2nd „ ditto.	ditto	127 „
45	1st (upper) bug intermediate.	Intermediate	128 mm.
	2nd „ ditto.	ditto	136 „
	3rd „ ditto.	ditto	137 „
46	1st (upper) bug *E. variolarius.*	Intermediate	116½ mm.
	2nd „ intermediate.	ditto	128 „
	3rd „ *E. variolarius.*	ditto	122 „
	4th „ ditto.	ditto	120 „
	5th „ intermediate.	ditto	136 „
	6th „ ditto.	ditto	127 „
47	1st (upper) bug intermediate.	Intermediate	119½ mm.
	2nd „ ditto.	ditto	110 „
	3rd „ ditto.	ditto	142 „
	4th „ ditto.	ditto	121 „
48	*E. variolarius.*	Intermediate	110 mm.

Mean length of intromittent organ, 128·27 mm.

Table 7.—F_2 males from the fifth pair of F_1 hybrids. (4 specimens.) Photos 15–16, Plate **41.**

Photos.	*Genital spot.*	*Intromittent organ.*	× 20 diams.
15	1st (upper) bug *E. variolarius.*	Intermediate	108 mm.
	2nd „ intermediate.	ditto	107½ „
	3rd „ ditto.	*E. servus*	147 „
16	*E. servus.*	Intermediate	135 mm.

Mean length of intromittent organ, 124·37 mm.

Table 8.—F_2 males from the sixth pair of F_1 hybrids. (6 specimens.) Photos 49–50, Plate **45**.

Photos.	Genital spot.	Intromittent organ.	×20 diams.
49	1st (upper) bug intermediate.	Intermediate	113½ mm.
	2nd ,, *E. servus.*	ditto	129½ ,,
50	1st (upper) bug intermediate.	Intermediate	128 mm.
	2nd ,, ditto.	ditto	128 ,,
	3rd ,, ditto.	ditto	125 ,,
	4th ,, ditto.	ditto	134 ,,

Mean length of intromittent organ, 126·33 mm.

Table 9.—F_2 males from the seventh pair of F_1 hybrids. Plate **46**. (32 specimens.)

Photos.	Genital spot.	Intromittent organ.	×20 diams.
51	1st (upper) bug intermediate.	Intermediate	110 mm.
	2nd ,, *E. servus.*	ditto	120 ,,
	3rd ,, ditto.	ditto	131 ,,
	4th ,, intermediate.	ditto	119 ,,
	5th ,, *E. servus.*	ditto	136½ ,,
	6th ,, ditto.	ditto	121½ ,,
	7th ,, ditto.	ditto	138 ,,
	8th ,, ditto.	ditto	115 ,,
	9th ,, intermediate.	ditto	122 ,,
52	1st (upper) bug *E. servus.*	Intermediate	127 mm.
	2nd ,, intermediate.	ditto	123½ ,,
	3rd ,, ditto.	ditto	112 ,,
	4th ,, *E. servus.*	ditto	128 ,,
	5th ,, ditto.	ditto	120 ,,
	6th ,, ditto.	ditto	136 ,,
53	1st (upper) bug intermediate.	Intermediate	115½ mm.
	2nd ,, ditto.	ditto	112 ,,
	3rd ,, ditto.	ditto	115 ,,
	4th ,, *E. servus.*	ditto	143½ ,,
54	1st (upper) bug intermediate.	Intermediate	130 mm.
	2nd ,, ditto.	ditto	120 ,,
	3rd ,, *E. servus.*	ditto	135 ,,
	4th ,, intermediate.	ditto	112 ,,
55	1st (upper) bug *E. variolarius.*	Intermediate	116½ mm.
	2nd ,, intermediate.	ditto	118 ,,
	3rd ,, ditto.	ditto	118 ,,
	4th ,, *E. servus.*	ditto	131 ,,
56	1st (upper) bug *E. variolarius.*	Intermediate	112½ mm.
	2nd ,, intermediate.	ditto	119 ,,
	3rd ,, *E. servus.*	ditto	129½ ,,
57	1st (upper) bug intermediate.	Intermediate	106½ mm.
	2nd ,, ditto.	ditto	120 ,,

Mean length of intromittent organ, 122·29 mm.

TABLE 10.—Summary of the above detailed results.

	No. of specimens with *E. variolarius* genital spot.	No. of specimens with *E. variolarius* length of intromittent organ. (Between $85\frac{1}{2}$ mm. and 106 mm.)	No. of specimens without genital spot (like *E. servus*).	No. of specimens with *E. servus* length of intromittent organ. (Between 146 mm. and 182 mm.)	No. of specimens with genital spot intermediate between *E. variolarius* and *E. servus*.	No. of specimens with length of intromittent organ intermediate between *E. variolarius* and *E. servus*.
F_2 males from 1st pair of F_1 hybrids (43 specimens). Photos 17–25.	1	9	25	5	17	29
F_2 males from 2nd pair of F_1 hybrids (30 specimens). Photos 26–32.	3	4	15	0	12	26
F_2 males from 3rd pair of F_1 hybrids (48 specimens). Photos 33–41.	8	1	13	1	27	46
F_2 males from 4th pair of F_1 hybrids (27 specimens). Photos 42–48.	4	0	5	0	18	27
F_2 males from 5th pair of F_1 hybrids (4 specimens). Photos 15–16.	1	0	1	1	2	3
F_2 males from 6th pair of F_1 hybrids (6 specimens). Photos 49–50.	0	0	1	0	5	6
F_2 males from 7th pair of F_1 hybrids (32 specimens). Photos 51–57.	2	0	14	0	16	32
TOTALS	19	14	74	7	97	169

Mean length of intromittent organ of the 190 F_2 hybrids, 124·42 mm.

TABLE 11.—Lengths of the intromittent organs in the 18 males from the Backcross (*i. e.* F_1 ♀ × pure *variolarius* ♂), side by side with the inheritance of the *E. variolarius* genital spot. A comparison demonstrates again that these two exclusively male characters are not linked in inheritance. Photos 62–66, Plate **47**.

Photos.	*Genital spot.*	*Intromittent organ.* × 20 diams.
62	1st (upper) bug *E. variolarius.*	Intermediate .... 112½ mm.
	2nd " ditto.	*E. variolarius* .... 105 "
	3rd " intermediate.	Intermediate .... 128½ "
	4th " ditto.	ditto .... 117 "
63	1st (upper) bug *E. variolarius.*	Intermediate .... 110½ mm.
	2nd " ditto.	ditto .... 116 "
	3rd " ditto.	*E. variolarius* .... 106 "
	4th " ditto.	Intermediate .... 107 "
64	1st (upper) bug *E. variolarius.*	Intermediate .... 115 mm.
	2nd " ditto.	ditto .... 112½ "
	3rd " intermediate.	ditto .... 122½ "
	4th " *E. variolarius.*	*E. variolarius* .... 102 "
	5th " intermediate.	Intermediate .... 119 "
	6th " *E. variolarius.*	ditto .... 118 "
65	*E. variolarius.*	Intermediate .... 113½ mm.
66	1st (upper) bug *E. variolarius.*	Intermediate .... 114½ mm.
	2nd " intermediate.	ditto .... 116½ "
	3rd " ditto.	ditto .... 106½ "

Mean length of intromittent organ, 113·47 mm.

It is an interesting fact that Mendel's Law of Heredity owed its inception in part to an analytical study of a size-character—the character which has proved on further investigation to be the greatest stumbling-block to an unqualified acceptance of the law as a wholly satisfactory explanation of the problems of heredity. In his original work on tall and dwarf peas, Mendel found that two lengths so far apart as 6 ft. and 1½ ft. acted as unit characters, and these characters showed dominance and segregation.

More recent work on size-relations has led to an accumulation of facts showing that in the majority of cases dominance and segregation in the Mendelian ratios of 1–2–1 are not present; and many Mendelians have made ingenious efforts to reconcile these facts with their conception of Mendelism by adding a superstructure to Mendel's original law, which has called forth an earnest protest from certain investigators.

Castle was the first Mendelian to demonstrate a case in which dominance and segregation were found to be absent where a length-character was carefully studied. He crossed the long-eared lop rabbit with the ordinary short-eared type, and found the F_1 generation with ears intermediate in

length, and no Mendelian segregation in the F_2 generation. These facts, together with further studies on size-relations, followed by his striking results in selection (Castle, '12 & '14), have led him to question certain hypotheses which he believes are quite unnecessary adjuncts to Mendelism.

As Castle believes that both small and large variations are inherited, he questions the mutation theory which claims "that only variations of some size are inherited".

As he believes in quantitative variations of unit characters, he questions the multiple factor hypothesis.

As he has demonstrated that quantitative variations can be increased by selection, he questions the hypothesis which denies this possibility (genotype theory).

Of unit characters he says: "In my experience *every* unit character is subject to quantitative variation, that is, its expression in the body varies, and it is clear that these variations have a germinal basis because they are inherited."

"It is the substantial integrity of a quantitative variation from cell-generation to cell-generation that constitutes the basis of Mendelism. All else is imaginary." (Castle, '12 *a*.)

Castle has arrived at his present conception of Mendelism through his extended and thoroughly scientific experiments on quantitative variations; and the results of his experimental studies of size-differences appear to be so completely in harmony with the results of our cross-breeding experiments with *Euschistus*, that we shall give a brief summary of his observations before we present the facts which seem to us to support them.

His wide experience in experimental breeding in relation to size-characters entitles him to speak with authority on this subject.

His observations may be briefly stated as follows:—

First. Dominance is absent in the F_1 hybrid generation.
Second. The F_1 hybrids are intermediate in size.
Third. Mendelian segregation is absent in the F_2 hybrid generation.
Fourth. There is increased variability in the F_2 generation as compared with the F_1 generation.
Fifth. The F_2 generation, like the F_1, is intermediate in size.
Sixth. Both extremes in size of the original parents may be found in the F_2 generation, but not in the F_1 generation.
Seventh. Size-characters, in common with all characters (even those that Mendelize), show quantitative variation.

We shall compare these observations with our own results, and when making this comparison we shall consider first the intromittent organ, and then the genital spot, in order to point out that the results from these two exclusively male characters are identical.

"First. *Dominance is absent in the F_1 hybrid generation.*"—This is supported by our measurements of the intromittent organ; for not one of the ten * F_1 hybrids has a length of intromittent organ that comes within the range characteristic of either *variolarius* or of *servus*. They are all intermediate: one measures 109 mm., one 122 mm., two 124 mm., four 126 mm., one 132 mm., and one 134 mm.†

Absence of dominance is equally evident in the case of the genital spot; for nine of the eleven F_1 hybrids are variable intermediates, while only two are like one of the parent species—*i. e.*, like *servus* in having no spot.

"Second. *The F_1 hybrids are intermediate in size.*"—This is quite true for both the intromittent organ and the genital spot, though it can be more clearly demonstrated in the former.

The mean length of the intromittent organ of *Euschistus variolarius* is 96·70 mm. (Table 1), and that of *E. servus* is 166·41 mm. (Table 2). A precise intermediate between these two means would be 131·55 mm. (*i. e.*, 34·85 mm. above the mean of *E. variolarius* or below the mean of *E. servus*).

The mean length of the organ in the F_1 hybrids computed from the ten specimens is 124·9 mm., which is slightly below the precise intermediate (131·55 mm.), and shows therefore a stronger inheritance from *E. variolarius* than from *E. servus*. The exact length of each specimen, as stated above, shows the F_1 intromittent organs to be *very variable* intermediates, ranging between 109 mm. and 134 mm. in length.

In the case of the genital spot the slightly stronger inheritance is from *E. servus* instead of from *E. variolarius*, for two of the eleven hybrids are like *servus* in having no spot. The remaining nine specimens are variable intermediates (photos 8 to 14, Plate 28 of this volume), and therefore the genital spot as well as the intromittent organ may be said to be approximately intermediate in size between the two parent species.

"Third. *Mendelian segregation is absent in the F_2 hybrid generation.*"—In our study of the transmission of the genital spot of *variolarius* (Foot and Strobell, '14 *a*) we divided the hybrids into three groups—those having a genital spot like those of pure *variolarius*, those without a spot like *servus*, and those with a spot intermediate between these two extremes. In the case of the intromittent organ we have grouped the hybrids into three similar classes—those having a length of intromittent organ within the range of that of *variolarius*, those with a length of organ within the range of that of *servus*, and those with a length intermediate between the longest found in *variolarius* and the shortest found in *servus*.

If we are looking for a simple Mendelian segregation of 1–2–1 and assume that the heterozygotes are represented by the intermediates, we should

* The intromittent organ of the eleventh F_1 hybrid was destroyed in dissection.

† These lengths are given in connection with each photograph (7 to 14), and can therefore be compared with the inheritance of the genital spot.

expect to find these two exclusively male characters in the F_2 hybrids in the following ratio :—25 % like *variolarius*, 25 % like *servus*, and 50 % intermediates. We ought to find 47 of the 190 F_2 hybrids like *variolarius*, 47 like *servus*, and 94 intermediates; whereas we find in the case of the intromittent organ 14 like *variolarius*, 7 like *servus*, and 169 intermediates (see Table 10), and in the case of the genital spot 19 like *variolarius*, 74 like *servus*, and 97 intermediates (Table 10). Both characters—the intromittent organ and the genital spot—are therefore like other size-characters in their failure to show Mendelian segregation in the F_2 generation.

"Fourth.—*There is increased variability in the F_2 generation as compared with the F_1 generation.*"—This appears at first sight to be true both for the intromittent organ and for the genital spot, but the evidence is unsatisfactory in that the number of individuals is so very different for the two generations, and, as variation is present in both generations, we must expect the larger number to give the larger number of variations. We have the exact length of the intromittent organ for 190 specimens of the F_2 generation, but have it for only 10 of the F_1 generation. There are 69 variations of length in the 190 F_2 hybrids (Tables 3 to 9), and only six variations in the ten F_1 hybrids. The latter, however, represents more variations in relation to the number of specimens than the 69 variations in the 190 F_2 hybrids.

These relations hold true also in the case of the genital spot, though the evidence here is not so exact, as the differences cannot be accurately measured as in the case of the intromittent organ.

On the whole we are not justified in claiming that the evidence is in accord with the observations on those size-characters which show that "there is increased variability in the F_2 generation as compared to the F_1 generation".

"Fifth. *The F_2 generation, like the F_1, is intermediate in size.*"—This point can again be most satisfactorily demonstrated in the case of the intromittent organ, for we know the mean length of the organ for both parent species, for the F_1 generation, the F_2 generation, and for the seven separate families of these F_2 hybrids.

As stated above, the theoretically precise intermediate between the mean lengths of the two parent species would be 131·55 mm.

The following are the mean lengths of intromittent organ of the F_2 males from the seven pairs of F_1 hybrids :—

1st pair of F_1 hybrids......	123·14 mm. (table 3).
2nd pair of F_1 hybrids......	120·67 mm. (table 4).
3rd pair of F_1 hybrids......	126·92 mm. (table 5).
4th pair of F_1 hybrids......	128·27 mm. (table 6).
5th pair of F_1 hybrids......	124·37 mm. (table 7).
6th pair of F_1 hybrids......	126·33 mm. (table 8).
7th pair of F_1 hybrids......	122·29 mm. (table 9).

The mean length of the intromittent organ computed from the total number of F_2 males (190 specimens) is 124·42 mm. A comparison of this with the mean length of the organ of the F_1 hybrids (124·9 mm.) shows that the mean length is almost the same for both the first and second generations, differing only by a few hundredths of a millimetre. It is clear therefore that the F_2 generation, like the F_1, is intermediate in size, and both agree further in showing a stronger inheritance from *variolarius* than from *servus*. This is true not only when the total number of F_2 hybrids is considered, but holds for each individual family of the F_2 generation—each of the seven families has a mean length of intromittent organ which is below the theoretical intermediate between the parent species (131·55 mm.).

"Sixth. *Both extremes in size of the original parents may be found in the F_2 generation, but not in the F_1 generation.*"—As the two characters we are testing are exclusively male, we can compare our results with the above observation only in the case of the original male parent. The length of the intromittent organ of the original *E. servus* male parent of the first cross is 166 mm., a length which has not been reached in any of the 190 specimens of the F_2 generation, the longest intromittent organ of all these F_2 hybrids measuring only 152 mm. (Table 3), and in only one specimen of the 190 was this length attained. We therefore cannot say that the length of the intromittent organ of this grandparent is found in our F_2 generation. If we disregard this length and take into consideration the *mean length* of the organ both in *servus* and in *variolarius*, we then find that a length of intromittent organ characteristic of both species is represented in the F_2 generation, and we find a still larger number like the two species, if we consider all the F_2 hybrids which have a length of organ within the limits of length characteristic of *variolarius* and *servus*. For example, 14 F_2 hybrids are like *variolarius* in having the length of intromittent organ 106 mm. or less, and 7 are like *servus* in having the length of intromittent organ 146 mm. or more (Tables 3 to 10).

Among the ten F_1 hybrids we find none with a length of organ like *E. variolarius* (106 mm. or less) nor any like *E. servus* (146 mm. or more), but we are inclined to believe that this is due to the relatively small number of specimens. As stated above, the relative number of variations in length of the intromittent organ of the ten F_1 hybrids is greater than that of the F_2 generation, and therefore we should expect a larger number of specimens to give us a larger range of variation. Even among these ten specimens we have one with the intromittent organ only 109 mm. long, and this is within 3 mm. of the *variolarius* type.

The results in the case of the genital spot are very similar. Nine of the eleven F_1 hybrids have a spot variably intermediate between that of the two parent species, but two are like *servus* in having no spot.

In the F_2 generation the extremes of the genital spot (*i. e.*, its full size and its complete absence) are represented, 19 of the F_2 hybrids having a genital spot almost if not quite as pronounced as the pure *variolarius* species, and 74 having no spot like *E. servus*.

"Seventh. *Size-characters, in common with all characters (even those that Mendelize), show quantitative variation.*"—Quantitative variation is of course more accurately demonstrated in the case of the intromittent organ than in the genital spot, though it is present in both these characters. Table 1 shows that in 62 specimens of *E. variolarius* the length of the organ varied between 85½ mm. and 106 mm., the range of the variation between the shortest and the longest being 20·5 mm. The table gives the number of specimens having the various lengths, and it demonstrates that there is no definite ascending or descending scale of variation in relation to the number of specimens having a given length of the organ, though the extremes are represented by only one specimen, and lengths near the mean are more frequently represented.

This is true also for *E. servus* as demonstrated in Table 2. This table gives the lengths of the intromittent organs for 62 specimens, and shows that this length varies between 146 mm. and 182 mm., the range of the variation between the shortest and the longest being therefore 36 mm.

Variations in the length of the intromittent organ may be quite independent of the relative size of the insects, not only in the hybrid generations, but also in the pure species: for example, the photographs of the two intromittent organs shown in photo 6 measure 104 mm. and 94 mm. The two insects from which these organs were taken are brothers of the *E. variolarius* female of the original cross. The one having the longer intromittent organ (104 mm.) is decidedly the smaller insect, the actual width of the pronotum (between the humeri) being 8½ mm., while the pronotum of the insect with the shorter organ measured 9½ mm.

Quantitative variation in the genital spot, though more difficult to demonstrate than in the intromittent organ, can be appreciated by comparing the male offspring from the same parents.

It is clear that all the points taken up under the above seven headings apply to the genital spot with quite as much force as to the intromittent organ—the size of the genital spot, like the length of intromittent organ, showing a type of inheritance that is nearly in full accord with Castle's observations on size-characters. In earlier papers these facts were clearly stated in the case of the genital spot (Foot and Strobell, '13 & '14 *a*), but it is interesting to note that Morgan ('14) interprets such evidence quite differently from Castle, for he says, "the authors' evidence shows that it (the genital spot) is inherited as are Mendelian characters" (page 481).

We do not feel justified, in view of the narrow limits of our experiments in genetics, in attempting to draw conclusions as to the possible bearing of

our results on Mendelism, or on the many ingenious hypotheses designed to adapt Mendel's law to some later experimental results. As, however, we are in entire sympathy with Castle's interpretation of size-characters, and believe his thorough knowledge of the subject entitles him to speak with authority, we would quote some of his recent conclusions that appear to us as sustained by the facts of our experimental work on both the intromittent organ and the genital spot of *Euschistus*.

Castle says:—"It is evident that size is not a simple unit character, for there is no dominance and no evidence of segregation other than the increased variability of the second hybrid generation. . . . .

"Dominance is clearly absent and the only fact suggesting segregation is the increased variability of the second as compared with the first hybrid generation. This fact, however, may be accounted for on other grounds than the existence of multiple units of varying power.

"If size-differences are due to quantitative variations in special materials within the cell, it is not necessary to suppose that these materials are localized in chunks of uniform and unvarying size, or that they occur in any particular number of chunks, yet the genotype hypothesis involves one or both of these assumptions. Both are unnecessary." (Castle, '12 *a*.)

"The results of all observers, as regards the inheritance of ordinary differences in size, are closely in accord. When two races differing in size are crossed the immediate offspring are intermediate in size. The next generation of offspring is likewise intermediate, but more variable as a rule, and it has been found possible in some cases to select from them forms as extreme in size as the original parents. To interpret such cases as Mendelian, requires the assumption that no single unit or factor is concerned in the size-difference, but many wholly independent units. For a single Mendelizing unit would produce a wholly different result. But suppose we allow the assumption that many independent Mendelizing units or factors are concerned in the inheritance of size. The pure line hypothesis is not benefited by this assumption unless we suppose further that these hypothetical factors do not vary. But this is an assumption wholly without warrant." (Castle, '14 *b*.)

"The *increased variability* of the F_2 generation is the only evidence of Mendelism in size crosses." . . . .

"On any hypothesis size-differences must depend on many mutually independent factors or causes . . . It would be rash to assume that all the factors concerned are Mendelizing factors, in the total absence of the two usual accompaniments and criteria of Mendelism, dominance and segregation in recognisable Mendelian ratios." (Page 2.)

He says the facts observed for body-size in rabbits and other quantitative characters in animals and plants are, F_1 intermediate and F_2 also intermediate, but more variable than F_1, and he adds, "If we call this Mendelism, we shall need to explain that it is not the Mendelism of Mendel himself, but original

Mendelism, *plus* (1) the assumption of gametic purity, *plus* (2) the assumption of factorial constancy, *plus* (3) the assumption of factorial multiplicity" (Castle, '14 *a*).

Results from backcross. F_1 hybrid female (from *E. variolarius* ♀ × *E. servus* ♂) by pure *E. variolarius* male. 18 males, photos 62–66.

This backcross was undertaken to obtain evidence as to whether the so-called male- and female-producing spermatozoa differ in their function in the transmission of the exclusively male character—the genital spot (Foot and Strobell, '13 & '14). We shall briefly re-state this evidence here in order to show that the original results are duplicated by the facts demonstrated in this paper as to the method of transmission of a second exclusively male character—the intromittent organ.

First, the so-called male-producing spermatozoon can transmit the genital spot. This was proved by the fact that the genital spot in the 18 males from this backcross is inherited *much more* strongly from the pure *variolarius* male than from the F_1 hybrid males, and therefore this *variolarius* character was transmitted directly from the male to its male offspring, and must, according to the hypothesis, have been transmitted by the male-producing spermatozoa *. This evidence is repeated in the case of the intromittent organ, for the mean length of the intromittent organ of these 18 males is 113·47 mm., while the mean length of the organ of the F_2 generation is 124·42 mm.—the measure therefore of the influence of the pure *variolarius* male in reducing the length of the intromittent organ may be expressed as 10·95 mm.

Second, this backcross demonstrated in the case of the genital spot that the *servus* character—the absence of spot—was transmitted by the so-called female-producing spermatozoon; and this evidence of the transmission of an exclusively male character by the female-producing spermatozoon is repeated in the case of the intromittent organ, for the length of the intromittent organ in these 18 males has been increased by the inheritance from *servus*. This is demonstrated by the fact that the mean length of the intromittent organ of the 18 males from this backcross is 113·47 mm., while that of the organ of the 62 pure *variolarius* males is 96·70 mm. The two *servus* characters—absence of spot, and increased length of intromittent organ—must have been transmitted (according to the hypothesis) by the so-called female-producing spermatozoon of *servus* to the pure *variolarius* ♀ of the first cross, through which it was transmitted to her daughter, the F_1 ♀ of this backcross.

The demonstration that the so-called sex-determining spermatozoa do not differ functionally in the transmission of such an exclusively male character

* In making these deductions it is of course necessary to accept, for the sake of the argument, the assumption of male- and female-producing spermatozoa, an assumption which we believe is still far from proved.

as the genital spot would seem to justify a good deal of scepticism of the sex-determination theory which is based on the assumption of male- and female-producing spermatozoa. This scepticism is greatly strengthened by the further evidence that these so-called male- and female-producing spermatozoa do not differ functionally in the transmission of such an exclusively male sexual character as the intromittent organ itself. Further, it seems only logical to believe, if exclusively *male* sexual characters are transmitted by both male- and female-producing spermatozoa, the same must be true also for the exclusively *female* sexual characters, for it is difficult to believe that the two sexes can have such fundamentally different modes of transmission.

If we measure the amount of the *variolarius* inheritance in this backcross, we find an astonishing agreement between the theoretical expectation and the actual result. The relative amount of *variolarius* to *servus* in the offspring of this backcross is 3 to 1, and we should expect, therefore, the mean length of the intromittent organ of *servus* to be reduced by 75 per cent. of the difference between the mean lengths in *variolarius* and *servus*. This difference is 69·71 mm., 75 per cent. of this being 52·28 mm. Deducting this from the mean length of the organ of *servus* (166·41 mm.) would leave 114·13 mm. as the mean length of the organ of the offspring from this backcross. The mean length is in fact 113·47 mm., this being only 0·66 mm. less than the calculated expectation.

These results lose much of their significance in view of the fact that only eighteen males were secured from this backcross, but the results are almost exactly repeated by a backcross with *E. ictericus*, in which 70 instead of 18 males were raised *.

The above method of computing the mean length of organ to be expected in the offspring from the two species, by a simple measure of the relative part each species has contributed in the crossings, is of interest only because the calculated results seem to fit the facts, but it certainly can have no bearing on cases that show the Mendelian type of inheritance, nor where simple unit characters are involved. Neither does it apply to the F_2 generation, for in each of the seven families the mean length is below an exact intermediate.

Table 11 demonstrates that the intromittent organs from the offspring of this backcross fail to show a typical Mendelian ratio, and as this is true also in the case of the genital spot, it is a further proof of the complete agreement in the results obtained from these two exclusively male characters.

* The mean length of the intromittent organ of the offspring from the *variolarius-ictericus* cross is also only a fraction of a millimetre less than the theoretical expectation, but in this cross the slightly stronger inheritance is from the original *male* parent, while in the *variolarius-servus* cross it is from the original *female* parent. In *both* crosses, however, the stronger inheritance is slightly on the side of the *shorter* type of intromittent organ. Our results from the *variolarius-ictericus* cross will be published shortly.

Linkage.

To the cytologist, linkage of characters in inheritance is of special interest because it is claimed that it affords the most trustworthy evidence that the factors determining linked characters are located in the same chromosome, and further it is claimed that this chromosome can be identified. Wilson has recently expressed this view clearly in his Croonian Lecture ('14). After giving a brief summary of the work of Morgan and his pupils on linked characters in *Drosophila*, he adds :—

"This at once suggests that the units of each group (or corresponding things on which they depend) are borne by a particular chromosome which constitutes their common vehicle of transmission, and that to this fact is due their cohesion or linkage in heredity. Conversely, the several groups are independent of one another, because of the independence of the chromosomes which bear them." (Page 344.)

If, as Wilson says, independence in the transmission of characters is due to independence of the chromosomes which bear them, the evidence obtained from our cross-breeding experiments would indicate that the factors determining the transmission of the intromittent organ are not only not carried by a single pair of chromosomes; but on the above hypothesis it would seem difficult to confine them to the 14 chromosomes, for among the 190 F_2 hybrids there are 69 different lengths of the intromittent organ, and if size-variations are due to multiple unit factors which are transmitted as independent units, these 69 variations would seem to demand an explanation from those who believe that "unit factors" are located in the chromosomes. Further, none of these 69 variations in the F_2 hybrids is consistently linked with any of the variations of the genital spot. We might reduce the number of independent variations of the intromittent organ and the genital spot by consigning most of them to the convenient class called "non-inheritable fluctuations", but this rather arbitrary process must be carried far, if the remaining "unit factors" are to be consigned to a single pair of chromosomes.

The "cross-over hypothesis", which was offered to explain unexpected results in the transmission of characters assumed to be carried by special chromosomes, might be used to excuse non-linkage in these extreme cases; but we cannot believe that it would be adequate to convince the unprejudiced investigator that the factors determining quantitative variations in the intromittent organ and genital spot are carried and distributed by the chromosomes. Even if we arbitrarily consign the determining factors to special positions in the chromosomes and dictate their subsequent method of division, it does not seem possible to adjust the facts with the view that linkage and non-linkage may have their explanation in chromosome-distribution of the factors.

In our preliminary report of this work (Foot and Strobell, '14 *c*) we discussed the non-linkage of the genital spot and intromittent organ as follows:—

"If factors which stand for a given character are carried by a definite chromosome or pair of chromosomes, and the inheritance of the character is due to a special distribution of the factors at mitosis, it would seem logical to expect that the factors of two characters showing a very special mode of distribution (*i. e.*, exclusively male characters) would be contained in the same chromosome, and that this would be indicated by their being linked in the hybrids. We would expect the absence or presence of the genital spot, distinctive of one species, to be associated in inheritance with the type of intromittent organ characteristic of the same species. Even if the extent to which a character appears is dependent upon hypothetical factors outside the chromosomes, we would expect these hypothetical factors to act equally on two characters which are so closely associated as to be contained in the same chromosome. We should expect the two characters never to be so entirely dissociated that we find, in the same individual, the absence of spot characteristic of one species, associated with the type of intromittent organ distinctive of the other species. Instances of such complete dissociation do, however, occur..... There are instances of association in the inheritance of the two characters, the intromittent organ and genital spot, typical of one of the species occurring in the same F_2 individual; but exact classification of the full results shows that the two characters are transmitted quite independently of each other. The intermediates, having a large range of variation, make it possible for many of them to appear to show the two characters in the association that would be in harmony with the chromosome-hypothesis, but an exact comparison shows two plus and two minus intermediates are quite as frequently associated as are a plus and a minus intermediate."

These facts are demonstrated in the foregoing tables (3–9), in which the type of inheritance of the genital spot and the length of intromittent organ in each particular insect of the F_2 generation are placed side by side. If we examine this evidence in detail, we find that 19 of these 190 F_2 males have a genital spot quite as strong as that of the pure *E. variolarius* male, while only 3 of these 19 males have the *E. variolarius* length of intromittent organ (*i. e.*, between $85\frac{1}{2}$ mm. and 106 mm.).

This evidence of non-linkage is even more clearly shown in those insects which have inherited the *servus* character (absence of the genital spot). There are 74 of these insects, and *only 3* have a length of intromittent organ which can be classed with *servus*, while on the other hand *4* have a length of intromittent organ characteristic of *variolarius*. The remaining 67, which have the absence of genital spot characteristic of *servus*, have a mean length of intromittent organ which shows a stronger influence from *variolarius*.

Tables 3 to 10 further demonstrate that while the influence of *variolarius*

is stronger than *servus* as regards the length of the intromittent organ, these relations are reversed in the case of the genital spot, and this is further demonstrated by those that are classed as intermediates, for of these more are minus than plus intermediates. It is therefore clear beyond question that these two exclusively male characters, the genital spot and the intromittent organ, are not linked in inheritance. These results are certainly out of harmony not only with the chromosome-hypothesis of sex-determination, but with the recent hypotheses of chromosome-distribution of unit factors.

The evidence from the F_1 generation is of less value, as we have only 11 specimens showing the inheritance of the genital spot, and we were not able to measure the length of intromittent organ of all the eleven, as one was destroyed in dissection.

The results from the F_1 generation are as follows:—2 of the eleven F_1 hybrids are like *servus* in having no genital spot, and the remaining 9 are variable intermediates. The two that have the *servus* inheritance (without a genital spot) have the following lengths of intromittent organ—126 mm. and 124 mm.; these lengths showing a stronger inheritance from *variolarius* as to the intromittent organ, while both insects show an exclusively *servus* inheritance in the absence of the genital spot.

The F_1 hybrid that has the longest intromittent organ—134 mm. (photo 11) —has the strongest genital spot of all the eleven F_1 hybrids, this again demonstrating a significant absence of linkage in these two exclusively male characters.

The mean length of the intromittent organs of the 10 F_1 hybrids is 124·9 mm., this demonstrating a stronger inheritance from *variolarius* than from *servus*. The difference between the mean length of *variolarius* (96·70 mm.) and of *servus* (166·41 mm.) is 69·71 mm., and therefore an exact intermediate between these two means would be 131·55 mm.—the measure therefore of the stronger *variolarius* inheritance in these F_1 hybrids may be expressed by 7·46 mm.

It is an interesting fact that the intromittent organ not only of this F_1 generation, but also of the F_2 generation, shows a stronger inheritance from *variolarius* than from *servus*, the measure of the greater *variolarius* influence being almost the same for the two generations, *i. e.*, 7·46 mm. in the case of the F_1 hybrids, and 7·13 mm. in the case of the F_2 hybrids.

While the intromittent organ of these 190 males shows a stronger inheritance from the *female* original parent (*variolarius*), the reverse is true of the genital spot, for only 19 of these 190 males have a spot as strong as *variolarius*, while 74 are like the *male* original part (*servus*) in having no spot.

It is not possible to make an accurate estimate of the influence of the two species on the type of genital spot classed as intermediate, but there are certainly more minus than plus intermediates, this further demonstrating that the genital spot shows a stronger inheritance from *servus* than from *variolarius*.

The results from the backcross demonstrate again that the genital spot and the intromittent organ are not linked in inheritance (Table 11). Twelve of these eighteen specimens have the *E. variolarius* spot on the genital segment, while only three have a length of intromittent organ characteristic of *variolarius*. Six have a spot on the genital segment which is more or less reduced by the inheritance from *E. servus*, which has no genital spot. These six are therefore intermediate as to the genital spot, while there are fifteen intermediate in the length of the intromittent organ.

Chromosomes.

Our experiments with these hemiptera were undertaken with the aim of testing some recent chromosome-theories of sex-determination by the trustworthy method of experimental cross-breeding. For this purpose we selected an exclusively male character—the distinct dark spot which is present on the genital segment of *Euschistus variolarius* and absent in *Euchistus servus*, for this character appeared to us well adapted to test the function of the so-called sex-chromosomes in the transmission of an exclusively male character.

The results of these cross-breeding experiments and their bearing on the chromosome-theories of sex-determination have been discussed in earlier papers, Foot and Strobell, '13 and '14 *a* & *b*. In the present paper we will summarize the evidence in order to demonstrate that the results gained by the study of the transmission of the genital spot are in fact duplicated in the case of the intromittent organ, and that therefore not only is the evidence gained through the study of the first greatly strengthened, but the conclusions bearing on chromosome-theories are fully sustained on every point.

In the preliminary report of our results from the study of this second exclusively male character we gave what appear to us very cogent reasons for claiming that this character should be classed as a primary sexual character. Both Morgan ('13) and Doncaster ('14*a* & '14*b*), in the case of the genital spot summarily dispose of our results and our claim that they have a valid bearing on the chromosome sex-determination hypothesis, by simply classing the genital spot with secondary sexual characters. Although there might be some ground for classing the genital spot with these characters, they are quite unlike in a most important feature, for a marked characteristic of the secondary sexual characters of authors is the fact that they can, almost without exception, be bred into the opposite sex. We do not believe that even these critics can thus dismiss the evidence obtained from a study of the transmission of the intromittent organ, although this evidence confirms in every detail the results demonstrated in the transmission of

the genital spot. For convenience we repeat the argument from our preliminary report.

Both Morgan and Doncaster class the genital spot of *variolarius* with the secondary sexual characters of authors, and they therefore interpret our results as not having the bearing on the theories of sex-determination which we claim for them. Now our claim has been that the genital spot of *variolarius* is an integral part of the male genital segment—the structure of the female genital segment being such that the spot could not be present in this segment without changing the form of the segment itself—and we have claimed that therefore a study of the transmission of the genital spot should give a trustworthy indication of the method of transmission of the entire genital segment.

This claim, that the method of transmission of the genital spot should be an index of the method of transmission of the genital organs of the male, has been completely justified by further work on these hybrids. . . The genetic results from our study of the genital spot of *variolarius* may be open to the criticism that as the spot is "not directly connected with the act of reproduction" it should be classed with the secondary sexual characters; but the intromittent organ is certainly free from such criticism and can be justly classed as a primary sexual character. In view of the fact that our results from the study of the transmission of the *variolarius* spot have been set aside on the ground that the spot is a secondary sexual character, and therefore has no bearing on the problem of the determination of sex, it is necessary first to establish the claim that the intromittent organ can be classed with the primary and not the secondary sexual characters. This apparently ought not to be difficult, but a difficulty does arise owing to the fact that recent authors who have discussed secondary sexual characters have avoided defining them, and have neglected to state wherein they are to be distinguished from the primary sexual characters.

According to Darwin ('59) Hunter defines secondary sexual characters as follows:—

"The term, secondary sexual characters, used by Hunter, applies to characters which are attached to one sex; but are not directly connected with the act of reproduction."

Darwin ('86) adopts Hunter's classification of primary and secondary sexual characters, but shows that even such an apparently clear-cut definition encounters difficulties. He says* :—"With animals which have their sexes separated, the males necessarily differ from the females in their organs of reproduction; *and these afford the primary sexual characters.* But the sexes often differ in what Hunter has called secondary sexual characters, which are *not directly connected with the act of reproduction*; for instance, in

* The italics are ours.

the male possessing certain organs of sense or locomotion, of which the female is quite destitute, or in having them more highly developed, in order that he may readily find or reach her; or again, in the male having special organs of prehension so as to hold her securely. These latter organs of infinitely diversified kinds graduate into, and in some cases can hardly be distinguished from, those which are commonly ranked as primary, such as the complex appendages at the apex of the abdomen in male insects. Unless indeed we confine the term 'primary' to the reproductive glands, it is scarcely possible to decide, as far as the organs of prehension are concerned, which ought to be called primary and which secondary" (p. 253).

Morgan ('13) also appears to accept Hunter's classification, for in his rather full list of secondary sexual characters he includes none that are "directly connected with the act of reproduction." He opens his discussion of secondary sexual characters as follows :—

"The Secondary Sexual Characters.

"In the most highly evolved stages in the evolution of sex a new kind of character makes its appearance. This is the *secondary sexual character*. In most cases such characters are more elaborate in the male, but occasionally in the female. They are the most astonishing thing that nature has done : brilliant colours, plumes, combs, wattles, and spurs, scent-glands (pleasant and unpleasant) ; red spots, yellow spots, green spots, topknots and tails, horns, lanterns for the dark, songs, howlings, dances and tourneys—a medley of odds and ends" (p. 26).

If we are to discard Hunter's classification, because it is found difficult to determine to which class some of the characters rightly belong, we should have to be dissatisfied with many classifications that are thoroughly well established.

If we limit the term "primary sexual characters" to the reproductive glands, it offers an escape from the difficulties in classifying the prehensile organs, as Darwin has pointed out; but it would seem that greater difficulties are met by refusing to place the intromittent organ in the same group with the reproductive glands, and placing it in the group with characters so far removed from "direct connection with the act of reproduction", as, for example, Morgan's list of secondary sexual characters. The intromittent organ is not only "directly connected with the act of reproduction", but it is as much a part of the sex of the individual as the reproductive glands themselves. Any one of the characters in Morgan's entire list of male secondary sexual characters could appear in the female without changing her sex; but the intromittent organ is as clearly indicative of the sex as are the reproductive glands themselves.

If a definite chromosome carries the factors for determining sex, and it therefore carries the factors for the reproductive glands, it would seem logical to suppose that the chromosome carrying the factors necessary for

the development of the male reproductive glands would also carry the factors necessary for the development of the intromittent organ which, when present, is functionally a necessary adjunct of the glands, and as indicative of the sex as the reproductive glands themselves. If we cannot accept the mode of transmission of the intromittent organ as an index of the mode of transmission of the reproductive glands, it would seem necessary to discard all structural features or other characters which are distinctive of the gonads of a given species, such as their distinction in size, form, colour, etc., and assume that these characters, associated with the gland, have a different mode of transmission from the gland itself.

This would prevent any experimental test being applied to the chromosome-theories of sex-determination and leave free scope for the wildest cytological speculations. If we should place the intromittent organ in the group of secondary sexual characters, because it has certain features in common with these characters, we ought logically to place the reproductive glands themselves in the same group. For example, both these organs, in common with most of the secondary sexual characters, can be transmitted to the opposite sex—hermaphrodites appearing in forms that are normally sexually distinct A case in point is Goodrich's ('12) interesting and important discovery of a male amphioxus in which 49 of the gonads were testes containing ripe spermatozoa and one was an ovary containing ripe ova. It may be urged that the intromittent organ is a secondary sexual character on the evidence that in the development of the embryo it appears much later than do the gonads—this indicating that the gonads are more fundamental and stable morphological entities. But there are facts opposed to this interpretation—Smith ('10) found that when the spider crab is infected by the parasite sacculina, the testes can become so greatly metamorphosed that some of the cells may develop into ova and *the same testis* contain *both* ripe ova and spermatozoa.

It would seem that the division between primary and secondary sexual characters, in common with almost all attempts at classification, has the objection that the line of demarcation is not, at all points, perfectly clear; but we believe, in spite of this, that we are justified in classing the intromittent organ as a primary sexual character, and that the results from the study of the transmission of this organ may justly be claimed as an index of the method of transmission of the reproductive glands themselves.

In the case of the genital spot the bearing of our results on recent chromosome-theories has been fully discussed in our earlier papers. We believe we clearly demonstrated that the facts are entirely out of harmony with all those hypotheses which claim to offer an explanation of the transmission of characters by the assumption that factors essential to their transmission are carried and distributed by definite chromosomes.

We have briefly summarized these results in a recent paper (Foot and Strobell, '14 *a*), and this summary will serve equally well for the second exclusively male character—the intromittent organ. This can be demonstrated by quoting the summary and changing it only enough to include the intromittent organ with the genital spot, as follows:—

First. Both the genital spot and the type of intromittent organ characteristic of each species can be inherited without the aid of the Y chromosome. This is proved by the fact that both are transmitted through the female, and the female does not possess the Y chromosome, as this chromosome is an exclusively male character.

Second. Both the genital spot and the type of intromittent organ can be inherited without the aid of the X chromosome. This is proved by the fact (demonstrated by the backcross) that they are transmitted through the male and *ex hypothesi* the male-producing spermatozoon does not have an X chromosome *.

We add, "In making these deductions it is, of course, necessary to accept, for the sake of the argument, the assumption of male- and female-producing spermatozoa, an assumption which, we believe, is far from proved." (See backcross p. 473.)

Third. The results show that if we assume that the factors necessary for the production of the genital spot and the intromittent organ are located in any of the ordinary chromosomes, they must be in at least both members of a pair of ordinary chromosomes, for the spot is directly transmitted through both the male and the female.

Fourth. The results show that, if we assume that the factors necessary for the production of the genital spot and the intromittent organ are carried by both members of a pair of chromosemes, we must assume that the female carries an inhibitor for the spot as well as for the intromittent organ, for neither is present in any of the females, though both are transmitted by the female, and therefore the factors for both are present, though not expressed.

Fifth. The results show that, although it is necessary to assume an inhibitor only in the *females* of the pure species, in the hybrids it becomes necessary to assume an inhibitor in the *males* also.

In his recent criticism of our work, Morgan ('14) overlooks the fact that the F_1 hybrid *males* have the spot more or less suppressed. In these males it is partly or wholly absent, and yet (like the females) they can directly

* Morgan ('14) seems to think that this point could have been made solely from the evidence of the F_2 ratio. He says: "It is unnecessary to repeat their argument; for if the factors were carried by the X chromosome only half the grandsons should show it, while, in fact, many more than half of them show it." We do not feel that this evidence would be conclusive, for it could be attacked by the assumption of an unequal death-rate—a convenient assumption which has been used more than once to excuse contradictory evidence.

transmit the spot to their male offspring. It seems only logical to believe that the causes, whatever they are, which inhibit the spot in the females are also responsible for its total or partial suppression in the F_1 hybrid males, but the causes suggested by our critics to account for its suppression in the females obviously cannot apply to the male hybrids. Morgan ('14), after admitting that the spot factors cannot be carried by the X or the Y chromosome, adds :—"We are concerned then only with a third possibility, viz. that there is something in the female condition itself that is inimical to the development of the spot." This something, he later explains, is the two X chromosomes. He says :—"The chemical interaction between two X's and the rest of the cell is of such kind that it produces a female, and the female complex, as such, is inimical to the development of a spot."

To the defenders of the chromosome-hypotheses, this may seem a plausible explanation of the suppression of the spot in the females which have these two X chromosomes, but it leaves unexplained the fact that the spot in the F_1 males is either wholly or partly suppressed, and these males have only one X chromosome, while two X chromosomes are held responsible for the suppression of the spot in the females.

The facts forced us to assume some sort of hypothetical inhibiting factors for the spot, not only for the females but for the F_1 male hybrids as well, and this is equally necessary for the case of the intromittent organ, since it is not only wholly inhibited in the females, but the length of organ strictly characteristic of either of the pure species is more or less inhibited in the F_1 hybrids. Further, the intromittent organ is like the spot in reappearing in the next generation in the length typical of the two parent species, proving this to have been latent in both the females and the F_1 males—its full expression being inhibited by unknown factors.

Sixth. The facts show, in the case of the genital spot, and we may now add in the case of the intromittent organ as well, that if we attempt to place this inhibitor in definite chromosomes, we meet with as serious difficulties as those involved in assuming that the factors essential for the production of the genital spot are carried by special chromosomes. In our preliminary report of these experiments ('13), we discussed in full the evident results of placing this inhibitor in various chromosomes—in the X chromosomes, in one of the ordinary chromosomes, or in a pair of chromosomes; and we found that none of these assumptions would accord with the facts. "The facts force us to regard these inhibitors as hypothetical forces which cannot logically be confined to the chromosomes, and are located we know not where—these hypothetical inhibitors practically doing work that has been assigned to definite chromosomes."

If the chromosome-hypotheses have a foundation in fact, it would seem only logical to expect that in these insects the Y chromosome should carry the factors for exclusively male characters, for it is the only one of the

14 chromosomes that is never present in the female, and is present in *all* the so-called male-producing spermatozoa, while each of the 13 autosomes (according to their accepted mode of division) can be present in half the male-producing and half the female-producing spermatozoa, and therefore in both half the males and half the females.

Even the defenders of the chromosome sex-determination hypothesis reject this Y chromosome as the carrier of factors essential for the determination of sex, for the very cogent reason that in so many forms no Y chromosome is present. Morgan ('11) concludes that "the factors for producing the male must be located in some other chromosome."

As the Y chromosome is thus rejected as a sex-determiner, it would seem that those who hold that factors essential for the development of definite characters are carried by definite chromosomes are forced to assign to the Y chromosome (in forms in which it is present) the function of carrying factors essential for the development of characters exclusively male, since, as stated above, it is the *only* chromosme that is *always* present in the male and absent in the female. We have shown, however, that such exclusively male characters as the genital spot and the intromittent organ can be inherited without the Y chromosome, and this certainly challenges such an interpretation, and leads us to respectfully ask the advocates of the chromosome-hypotheses what characters they would assign to it.

An ingenious apology for the obvious shortcomings of the sex-chromosome hypothesis has been recently made by C. B. Bridges, '13 (one of Morgan's pupils). It is offered as an explanation of occasional slips in linkage. Bridges found in *Drosophila ampelophila* that two sex-linked characters (red eye and white eye) failed to show linkage in 5 per cent. of the cases (Wilson, '14, states that these exceptions are "about 10 per cent.").

To the class of cytologists to which Bridges belongs, "sex-linked characters" are in reality *X-linked*, and therefore, for example, it is theoretically impossible for a male to transmit directly to his male offspring a character that is assumed to be carried by the X chromosome—the chromosome that is absent from the male-producing spermatozoon. In order then to explain away these embarrassing slips in linkage, Bridges has submitted the following ingenious explanation, which is based on the admission that the X chromsomes do not move during maturation with that military precision heretofore demanded by the theories. He now suggests each may show an equal amount of erratic movement—the one destined for the polar body may remain in the egg, and the one destined to remain in the egg may go with its mate to the polar body ; and thus three kinds of ripe eggs are possible—the first with the usual one X, the second with no X at all, and the third with two X's. This erratic behaviour of the X chromosomes can be made to account for many disappointments in expected results,

and incidentally it relieves the so-called male- and female-producing spermatozoa *as such* from the responsibility of deciding the sex, and places it squarely with the egg, for from a so-called male-producing spermatozoon a female can develop if this spermatozoon fertilizes an egg in which both X chromosomes have remained, and again from a so-called female-producing spermatozoon a male can develop if this spermatozoon fertilizes an egg which has no X chromosome.*

It is naturally incumbent upon the cytologist who makes assumptions so necessary for the defence of a theory to find some cytological proof of them, and Wilson ('14) has made the interesting announcement that "very recently Bridges has tested his assumption cytologically". And he adds, "The cytological examination has demonstrated that certain females of this race actually possess three of these chromosomes."

Wilson seems to regard this evidence as quite conclusive proof of Bridges' assumptions and deductions. Those of us, however, who have no such sublime faith in the causal nature of the chromosomes are inclined to suspect that if Bridges had searched with equal ardour for an extra X chromosome in the male cells, he might have found these cells also equipped with an extra X chromosome, as in fact we found to be the case in the spermatogonia of *Anasa tristis* (Foot and Strobell, '07). In spite of our demonstrating this second X chromosome by photomicrographs, the reality of its presence has been questioned by advocates of the chromosome-theories, for it is obviously an embarrassing factor to the sex-determination hypothesis.

Further study of the chromosomes of the Hemiptera led us to make the following statement which seems to us to have some bearing on Bridges' recent discovery:—"A careful examination of our preparations makes it possible to select chromosome-groups which exactly fit a given theory, but many groups can also be found that are a serious menace to these theories, while, on the other hand, they present no difficulties to the conception of those who regard the number, size, and form of the chromosomes as inherited characters—the expression of cell-activities rather than the cause."

In our preliminary report (Foot and Strobell, '14 *c*, pp. 228–31) we showed by an analysis of the chromosomes, based on the hypotheses as to their method of division, that the testis itself can have no closer relation to the so-called sex-determining chromosomes than we have shown to be the case

* Bridges' assumptions, when applied to those forms which have a Y chromosome, would seem to relieve this chromosome of any sex-limited function, although in these species it is just as distinctive of the male cells as are the two X chromosomes of the female cells. According to Bridges' hypothesis, some males may be without the Y chromosome, while some females have it. The admission that such marked structural changes in the male and female chromosome groups can occur in individuals is in harmony with the belief that the chromosomes, like other structures in the cell, are the expression rather than the cause of cell activities.

for the other two exclusively male characters—the genital spot and the intromittent organ. These three exclusively male characters—the genital spot, the intromittent organ, and the testis—can therefore, according to the hypothesis, be transmitted by the female-producing spermatozoon as well as by the male-producing spermatozoon.

The defenders of the chromosome-hypothesis of sex-determination would have us ignore these facts. Morgan ('14) says :—"To assume that all the factors for characters that are shown by the male or by the female must be carried by a sex-chromosome *of some kind*, if carried at all by chromosomes, is a travesty of the point of view of those who hold to the chromosome-hypothesis as a reasonable working hypothesis to account for Mendelian inheritance." This sounds like an effort to evade the force of the real facts. It should be added that two of these "*characters*" (the intromittent organ and the testis) are so exclusively male that without them the insect would not be a male, and to present these facts and the conclusions which they logically involve can scarcely be called "*a travesty*" of the hypothesis that asserts that factors determining sex are carried and distributed by "*sex-chromosomes.*" Rather it is a serious and perfectly logical challenge of some recent extreme views as to the function of the chromosomes in heredity.

Oxford, March 1915.

References.

Bridges, Calvin B.

'13. Non-disjunction of the Sex Chromosomes of *Drosophila*. Journ. Exper. Zool. vol. xv. No. 4.

Castle, W. E.

'11. Heredity in Relation to Evolution and Animal Breeding. D. Appleton & Company. 1911.

'12 *a*. The The Inconstancy of Unit-characters. Amer. Nat. vol. xlvi.

'12 *b*. Some Biological Principles of Animal Breeding. Amer. Breeders' Magazine, vol. iii. No. 4.

'14 *a*. Multiple Factors in Heredity. Science, n. s. vol. xxxix.

'14 *b*. Pure Lines and Selection. Journ. of Heredity (Organ of the Amer. Genetic Assoc.), Washington, D.C., vol. v. No. 3.

Castle, W. E., and John C. Phillips,

'14 *c*. Piebald Rats and Selection. An experimental test of the effectiveness of selection and of the theory of gametic purity in Mendelian crosses. Carnegie Institution of Washington, 1914.

Darwin, Charles Robert.

'59. The Origin of Species. 1859.

'86. The Descent of Man. 1886.

DONCASTER, LEONARD.

'14 *a*. Heredity and Sex—A Review of the Present State of Evidence with regard to the material basis of Heredity, Transmission, and Sex-determination. Q. J. M. Sci. vol. liv.

'14 *b*. The Determination of Sex. Cambridge University Press.

FOOT, KATHARINE, and E. C. STROBELL.

'07. A Study of Chromosomes in the Spermatogenesis of *Anasa tristis*. Amer. Journ. Anat. vol. vii. No. 2.

'09. The Nucleoli in the Spermatocytes and Germinal Vesicles of *Euschistus variolarius*. Biol. Bull. vol. xvi. No. 5.

'13. Preliminary Note on the Results of crossing two Hemipterous Species, with Reference to the Inheritance of an Exclusively Male Character and its bearing on Modern Chromosome Theories. Biol. Bull. vol. xxiv. No. 3.

'14 *a*. Results of crossing *Euschistus variolarius* and *Euschistus servus* with Reference to the Inheritance of an Exclusively Male Character. Journ. Linn. Soc. London, Zool. vol. xxxii.

'14 *b*. The Chromosomes of *Euschistus variolarius*, *Euschistus servus*, and the Hybrids of the F_1 and F_2 Generations. Arch. für Zellf., Bd. 12.

'14 *c*. Preliminary Report of crossing two Hemipterous Species with Reference to the Inheritance of a Second Exclusively Male Character. Biol. Bull. vol. xxvii. No. 4.

GOODRICH, EDWIN STEPHEN.

'12. A Case of Hermaphroditism in *Amphioxus*. Anat. Anz., Bd. 42.

MORGAN, THOMAS HUNT.

'11. An Attempt to Analyse the Constitution of the Chromosomes on the Basis of Sex-limited Inheritance in *Drosophila*. Journ. Exp. Zool. vol. xi. No. 4.

'13. Heredity and Sex. Columbia University Press. 1913.

'14. Sex-limited and Sex-linked Inheritance. Amer. Nat. vol. xlviii.

SMITH, GEOFFREY WATKIN.

'10. Studies in the Experimental Analysis of Sex. Q. J. M. Sci. vol. lv. pt. 2.

WILSON, EDMUND BEECHER.

'14. Croonian Lecture. Proc. Royal Soc., ser. B, vol. lxxxviii. No. B 603.

EXPLANATION OF THE PLATES.

All the preparations were photographed at exactly the same magnification (20 diameters), and the photograph of each intromittent organ was carefully measured with a small pair of architect's dividers, fitted with number nine needle-points, and set at 2 mm. The dividers were frequently tested by measuring a line of a definite length. The measurements were made on matte prints, so that each division of 20 mm. could be identified by a pencil-mark and numbered. Measurement of the longer and more closely coiled organs was facilitated by dotting the first coil with red ink, the second coil with blue ink, and leaving the third coil black. In this way the longest coil could then be measured with as much accuracy as the shortest. The measurements were made from the distal end of the intromittent organ to the point where the thick part of the coil enters the gland. At this point the coil is easily dissected off (*e. g.*, photos 12 & 13), but even in those cases where part of the canal within the gland has been preserved (*e. g.*, photo 1) the point from which the measurement was taken is easily determined, for the part within the gland is transparent and quickly tapers to a very fine canal.

The intromittent organs of photos 1 to 66 are from the same insects which were photographed in an earlier paper and published in this same volume of the Journ. Linn. Soc., Zool. (see Plates **28** to **34**).

In order to demonstrate whether these two exclusively male characters—the genital spot and the intromittent organ—are linked in inheritance, we have placed the intromittent organs of photos 1 to 66 in exactly the same order in which the photographs of the bugs themselves were placed on the plates of the above-mentioned paper—each photograph in the two sets of illustrations *exactly corresponding*, and thus admitting an accurate comparison of the genital spot and the intromittent organ of each individual bug of the entire series.

The photographs are reproduced by the half-tone method. Frequently it does not accurately reproduce the distal end of the intromittent organs, which always terminate in a clean-cut oblique angle: this is sometimes obscured by the dotted effect of the half-tone method, giving the appearance of a broken, jagged end. In some cases the reproducers have attempted to correct this by retouching; but this has not always been successful.

Plate **41**.

(*Cf.* Plate **28** of this volume.)

Photo 1. Intromittent organs from the two bugs of photo 1, plate 28. On the left *E. variolarius*, and on the right *E. servus*. Length of intromittent organ of *E. variolarius* 95 mm., of *E. servus* 167 mm.

Photo 2. Intromittent organs from the seven *E. variolarius* of photo 2, plate 28. These insects were raised in our laboratory during the summer of 1912. The parent bugs were raised in our laboratory during the summer of 1911, and were kept in captivity during the winter of 1911–12. Lengths of the intromittent organs of the seven bugs are as follows:—1st (upper), 96 mm. 2nd, 101 mm. 3rd, 96 mm. 4th, 93 mm. 5th, 90 mm. 6th, 96 mm. 7th, 92 mm.

Photo 3. Intromittent organs from the five *E. servus* of photo 3, plate 28. The bugs were collected in North Carolina in the fall of 1912. Lengths of the intromittent organs:—1st (upper), 164½ mm. 2nd, 164½ mm. 3rd, 175½ mm. 4th, 166 mm. 5th, 170 mm.

Photo 4. Intromittent organ of the wild *E. servus* of photo 4, plate 28. This male fertilized the *E. variolarius* female used for our cross-breeding experiments. Length of intromittent organ, 166 mm.

PHOTO 5. Intromittent organs of the five *E. servus* that were caged during the winter of 1911–12 with three *E. variolarius* females, one of which was used for our cross-breeding experiments. (The last three of these five males are shown in photo 5, plate 28.) Lengths of the intromittent organs:—1st (upper), 161 mm. 2nd, 162 mm. 3rd, 166 mm. 4th, 146 mm. 5th, 169 mm.

PHOTO 6. Intromittent organs from two *E. variolarius*. These males were raised from the same deposition of eggs from which we raised the females for our cross-breeding experiments. Only one of these males (the 2nd) is shown in photo 5, plate 28. Lengths of the intromittent organs:—1st (upper), 104 mm. 2nd, 94 mm.

PHOTO 7. Intromittent organs from the two F_1 hybrids of photo 7, plate 28. Lengths of the intromittent organs:—1st (upper), 126 mm. 2nd, 124 mm.

PHOTO 8. Intromittent organs from the two F_1 hybrids of photo 8, plate 28. Lengths of the intromittent organs:—1st (upper), 126 mm. 2nd, 124 mm.

PHOTO 9. Intromittent organ from the one F_1 hybrid that was preserved as a pinned specimen. This is the only intromittent organ that cannot be compared with a photograph of the insect from which it was dissected. The intromittent organ of the insect of photo 9, plate 28, was broken in dissection, and we therefore replaced it with this organ from the dried specimen. Length, 126 mm.

PHOTO 10. Intromittent organ of the F_1 hybrid of photo 10, plate 28. Length of intromittent organ, 109 mm. (This includes 3 mm. for the extreme distal end that was broken off in dissection and not preserved.) This hybrid is the male parent of the F_2 hybrids of plate 31.

PHOTO 11. Intromittent organ of the F_1 hybrid of photo 11, plate 28. Length of intromittent organ, 134 mm.

This hybrid is the male parent of the F_2 hybrids of photos 15 and 16, plate 28.

PHOTO 12. Intromittent organ of the F_1 hybrid of photo 12, plate 28. Length of intromittent organ, 132 mm.

This hybrid is the male parent of the F_2 hybrids of photos 42 to 48, plate 32.

PHOTO 13. Intromittent organ of the F_1 hybrid of photo 13, plate 28. Length of intromittent organ, 122 mm.

This male fertilized the two F_1 females of the 6th and 7th pairs of F_1 hybrids, and is therefore the male parent of the F_2 hybrids of photos 49 to 57, plates 32 & 33.

PHOTO 14. Intromittent organ of the F_1 hybrid of photo 14, plate 28. Length of intromittent organ, 126 mm.

This hybrid is the male parent of the F_2 hybrids of photos 26 to 32, plate 30.

PHOTOS 15 & 16. Intromittent organs from the four F_2 males from the fifth pair of F_1 hybrids.

PHOTO 15. Intromittent organs of the three F_2 hybrids of photo 15, plate 28. Length of intromittent organs:—1st (upper), 108 mm. 2nd, 107½ mm. 3rd, 147 mm.

PHOTO 16. Intromittent organ of the F_2 hybrid of photo 16, plate 28. Length of intromittent organ, 135 mm. (See photo 11 for the intromittent organ of the male parent of the four F_2 hybrids of photos 15 and 16.)

Plate **42**.

(*Cf.* Plate **29** of this volume.)

The intromittent organs from 43 F_2 males from the first pair of F_1 hybrids. The male parent of these hybrids is shown in photo 9, plate 28, but we did not succeed in preserving its intromittent organ (see photo 9).

Photo 17. Intromittent organs from the five F_2 hybrids of photo 17, plate 29. Lengths of intromittent organs:—1st (upper), 96 mm. 2nd, 146 mm. 3rd, 130 mm. 4th, 136 mm. 5th, 150 mm.

Photo 18. Intromittent organs from the five F_2 hybrids of photo 18, plate 29. Lengths of intromittent organs:—1st (upper), 112½ mm. 2nd, 128 mm. 3rd, 122 mm. 4th, 137 mm. 5th, 148 mm.

Photo 19. Intromittent organs of the four F_2 hybrids of photo 19, plate 29. Lengths of intromittent organs:—1st (upper), 114 mm. 2nd, 129 mm. 3rd, 139½ mm. 4th, 144 mm.

Photo 20. Intromittent organs of the three F_2 hybrids of photo 20, plate 29. Lengths of intromittent organs:—1st (upper), 130 mm. 2nd, 120 mm. 3rd, 98 mm.

Photo 21. Intromittent organs of the six F_2 hybrids of photo 21, plate 29. Lengths of intromittent organs:—1st (upper), 124 mm. 2nd, 152 mm. 3rd, 133 mm. 4th, 122 mm. 5th, 136 mm. 6th, 97 mm.

Photo 22. Intromittent organs of the five F_2 hybrids of photo 22, plate 29. Lengths of intromittent organs:—1st (upper), 136 mm. 2nd, 146 mm. 3rd, 124 mm. 4th, 128½ mm. 5th, 130 mm.

Photo 23. Intromittent organs of the four F_2 hybrids of photo 23, plate 29. Lengths of intromittent organs:—1st (upper), 98 mm. 2nd, 120 mm. 3rd, 104 mm. 4th, 122 mm.

Photo 24. Intromittent organs of the three F_2 hybrids of photo 24, plate 29. Lengths of intromittent organs:—1st (upper), 100 mm. 2nd, 114 mm. 3rd, 132½ mm.

Photo 25. Intromittent organs of the eight F_2 hybrids of photo 25, plate 29. Lengths of intromittent organs:—1st (upper), 114½ mm. 2nd, 123 mm. 3rd, 100 mm. 4th, 108 mm. 5th, 93 mm. 6th, 132 mm. 7th, 85½ mm. 8th, 140 mm.

Plate **43**.

(*Cf.* Plate **30** of this volume.)

Intromittent organs from 30 F_2 males, from the second pair of F_1 hybrids. The male parent of these hybrids is shown in photo 14, plate 28, and its intromittent organ in photo 14, Plate **41**.

Photo 26. Intromittent organs from the five bugs of photo 26, plate 30. Lengths of intromittent organs:—1st (upper), 115½ mm. 2nd, 100 mm. 3rd, 116 mm. 4th, 118 mm. 5th, 118 mm.

Photo 27. Intromittent organs from the four bugs of photo 27, plate 30. Lengths of intromittent organs:—1st (upper), 99 mm. (this includes 3 mm. for the extreme distal end that was broken off in dissection and not preserved). 2nd, 130 mm. 3rd, 130 mm. 4th, 130 mm.

Photo 28. Intromittent organs from the six bugs of photo 28, plate 30. Lengths of intromittent organs:—1st (upper), 90 mm. 2nd, 142 mm. 3rd, 124 mm. 4th, 131 mm. 5th, 121 mm. 6th, 127½ mm.

Photo 29. Intromittent organs from the five bugs of photo 29, plate 30. Lengths of intromittent organs:—1st (upper), 124 mm. 2nd, 123 mm. 3rd, 125 mm. 4th, 126 mm. 5th, 126 mm.

PHOTO 30. Intromittent organs from the four bugs of photo 30, plate 30. Lengths of intromittent organs:—1st (upper), 130 mm. 2nd, 134½ mm. 3rd, 115½ mm. 4th, 133 mm. (this includes 3 mm. for the extreme distal end that was broken off in dissection and not preserved).

PHOTO 31. Intromittent organs from the three bugs of photo 31, plate 30. Lengths of intromittent organs:—1st (upper), 114 mm. 2nd, 114 mm. 3rd, 99½ mm.

PHOTO 32. Intromittent organs from the three bugs of photo 32, plate 30. Lengths of intromittent organs:—1st (upper), 114½ mm. 2nd, 122 mm. 3rd, 127 mm.

PLATE **44**.

(*Cf.* Plate **31** of this volume.)

Intromittent organs from 48 F_2 males from the third pair of F_1 hybrids. The male parent of these hybrids is shown in photo 10, plate 28, and its intromittent organ in photo 10, Plate **41**.

PHOTO 33. Intromittent organs from the six bugs of photo 33, plate 31. Lengths of intromittent organs:—1st (upper), 117½ mm. 2nd, 124 mm. 3rd, 116½ mm. 4th, 144 mm. 5th, 123½ mm. 6th, 130 mm.

PHOTO 34. Intromittent organs from the eight bugs of photo 34, plate 31. Lengths of intromittent organs:—1st (upper), 128 mm. 2nd, 131 mm. 3rd, 140 mm. 4th, 130 mm. 5th, 140 mm. 6th, 121 mm. 7th, 123 mm. 8th, 147 mm.

PHOTO 35. Intromittent organs from the five bugs of photo 35, plate 31. Lengths of intromittent organs:—1st (upper), 104 mm. 2nd, 115 mm. 3rd, 126 mm. 4th, 134 mm. 5th, 134½ mm.

PHOTO 36. Intromittent organs from the seven bugs of photo 36, plate 31. Lengths of intromittent organs:—1st (upper), 114 mm. 2nd, 127½ mm. 3rd, 127½ mm. 4th, 124 mm. 5th, 142 mm. 6th, 120 mm. 7th, 127½ mm.

PHOTO 37. Intromittent organs from the three bugs of photo 37, plate 31. Lengths of intromittent organs:—1st (upper), 122½ mm. 2nd, 122½ mm. 3rd, 126 mm.

PHOTO 38. Intromittent organs from the five bugs of photo 38, plate 31. Lengths of intromittent organs:—1st (upper), 112 mm. 2nd, 120 mm. 3rd, 126 mm. 4th, 139½ mm. 5th, 140 mm.

PHOTO 39. Intromittent organs from the four bugs of photo 39, plate 31. Lengths of intromittent organs:—1st (upper), 137 mm. 2nd, 134½ mm. 3rd, 140 mm. 4th, 124 mm.

PHOTO 40. Intromittent organs from the seven bugs of photo 40, plate 31. Lengths of intromittent organs:—1st (upper), 114½ mm. 2nd, 117 mm. 3rd, 122 mm. 4th, 136½ mm. 5th, 126 mm. 6th, 126½ mm. 7th, 120 mm.

PHOTO 41. Intromittent organs from the three bugs of photo 41, plate 31. Lengths of intromittent organs:—1st (upper), 116½ mm. 2nd, 132 mm. 3rd, 126 mm.

PLATE **45**.

(*Cf.* Plate **32** of this volume.)

PHOTOS 42-48. Intromittent organs from the 27 F_2 males from the fourth pair of F_1 hybrids. The male parent of these hybrids is shown in photo 12, plate 28, and its intromittent organ in photo 12, Plate **41**.

PHOTO 42. Intromittent organs from the four bugs of photo 42, plate 32. Lengths of intromittent organs:—1st (upper). 142 mm. 2nd, 130 mm. 3rd, 130½ mm. 4th, 136 mm.

PHOTO 43. Intromittent organs from the seven bugs of photo 43, plate 32. Lengths of intromittent organs:—1st (upper), 118½ mm. 2nd, 132 mm. 3rd, 140 mm. 4th, 133 mm. 5th, 127 mm. 6th, 138 mm. 7th, 141½ mm.

PHOTO 44. Intromittent organs from the two bugs of photo 44, plate 32. Lengths of intromittent organs:—1st (upper), 115 mm. 2nd, 127 mm.

PHOTO 45. Intromittent organs from the three bugs of photo 45, plate 32. Lengths of intromittent organs:—1st (upper), 128 mm. 2nd, 136 mm. 3rd, 137 mm.

PHOTO 46. Intromittent organs from the six bugs of photo 46, plate 32. Lengths of intromittent organs:—1st (upper), 116½ mm. 2nd, 128 mm. 3rd, 122 mm. 4th, 120 mm. 5th, 136 mm. 6th, 127 mm.

PHOTO 47. Intromittent organs from the four bugs of photo 47, plate 32. Lengths of intromittent organs:—1st (upper), 119½ mm. 2nd, 110 mm. 3rd, 142 mm. 4th, 121 mm.

PHOTO 48. Intromittent organ from the male of photo 48, plate 32. Length of intromittent organ, 110 mm.

PHOTOS 49 & 50. Intromittent organs from the six F_2 males from the sixth pair of F_1 hybrids. The male parent of these hybrids is shown in photo 13, plate 28, and its intromittent organ in photo 13, Plate **41**.

PHOTO 49. Intromittent organs from the two bugs of photo 49, plate 32. Lengths of intromittent organs:—1st (upper), 113½ mm. 2nd, 129½ mm.

PHOTO 50. Intromittent organs from the four bugs of photo 50, plate 32. Lengths of intromittent organs:—1st (upper), 128 mm. 2nd, 128 mm. 3rd, 125 mm. 4th, 134 mm.

PLATE **46**.

(*Cf.* Plate **33** of this volume.)

Intromittent organs from 32 F_2 males from the seventh pair of F_1 hybrids. The male parent of these hybrids is shown in photo 13, plate 28, and its intromittent organ in photo 13, Plate **41**.

PHOTO 51. Intromittent organs from the nine bugs of photo 51, plate 33. Lengths of intromittent organs:—1st (upper), 110 mm. 2nd, 120 mm. 3rd, 131 mm. 4th, 119 mm. 5th, 136½ mm. 6th, 121½ mm. 7th, 138 mm. 8th, 115 mm. 9th, 122 mm.

PHOTO 52. Intromittent organs from the six bugs of photo 52, plate 33. Lengths of intromittent organs:—1st (upper), 127 mm. 2nd, 123½ mm. 3rd, 112 mm. 4th, 128 mm. 5th, 120 mm. 6th, 136 mm.

PHOTO 53. Intromittent organs from the four bugs of photo 53, plate 33. Lengths of intromittent organs:—1st (upper), 115½ mm. 2nd, 112 mm. 3rd, 115 mm. 4th, 143½ mm.

PHOTO 54. Intromittent organs from the four bugs of photo 54, plate 33. Lengths of intromittent organs:—1st (upper), 130 mm. 2nd, 120 mm. 3rd, 135 mm. 4th, 112 mm.

PHOTO 55. Intromittent organs from the four bugs of photo 55, plate 33. Lengths of intromittent organs:—1st (upper), 116½ mm. 2nd, 118 mm. 3rd, 118 mm. 4th, 131 mm.

PHOTO 56. Intromittent organs from the three bugs of photo 56, plate 33. Lengths of intromittent organs:—1st (upper), 112½ mm. 2nd, 119 mm. 3rd, 129½ mm.

PHOTO 57. Intromittent organs from the two bugs of photo 57, plate 33. Lengths of intromittent organs:—1st (upper), 106½ mm. 2nd, 120 mm.

PLATE **47**.

(*Cf.* Plate **34** of this volume.)

PHOTO 58. The intromittent organ from the pure *variolarius* of photo 58, plate 34. Length of intromittent organ, 94 mm. This pure *variolarius* male was raised in the laboratory in 1912, and the same season fertilized both a pure female *variolarius* and an F_1 hybrid female.

PHOTOS 59–61. Intromittent organs of 10 males from the above-mentioned pair of pure *variolarius*.

PHOTO 59. Intromittent organ of the male of photo 59, plate 34. Length of intromittent organ, 94 mm.

PHOTO 60. Intromittent organs of the three males of photo 60, plate 34. Lengths of intromittent organs:—1st (upper), 98 mm. 2nd, 100 mm. 3rd, 94 mm.

PHOTO 61. Intromittent organs of the six males of photo 61, plate 34. Lengths of intromittent organs:—1st (upper), 100 mm. 2nd, 100 mm. 3rd, 100 mm. 4th, 95½ mm. 5th, 102 mm. 6th, 98 mm.

PHOTOS 62–66. Intromittent organs of 18 males from the above-mentioned backcross (F_1 hybrid ♀ × pure *variolarius* ♂).

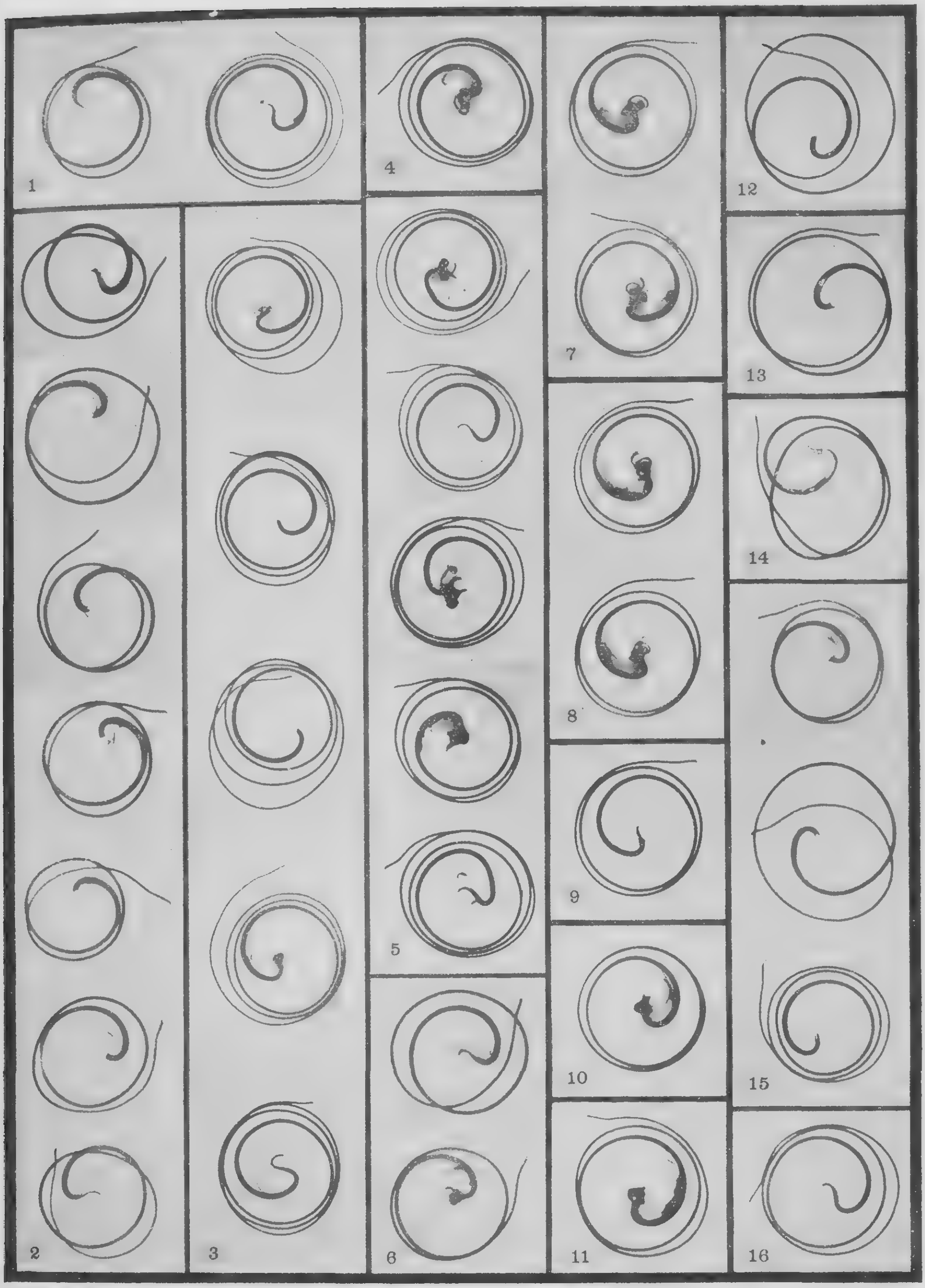
PHOTO 62. Intromittent organs from the four males of Photo 62, plate 34. Lengths of intromittent organs:—1st (upper), 112½ mm. 2nd, 105 mm. 3rd, 128½ mm. 4th, 117 mm.

PHOTO 63. Intromittent organs from the four males of photo 63, plate 34. Lengths of intromittent organs:—1st (upper), 110½ mm. 2nd, 116 mm. 3rd, 106 mm. 4th, 107 mm.

PHOTO 64. Intromittent organs from the six males of photo 64, plate 34. Lengths of intromittent organs:—1st (upper), 115 mm. 2nd, 112½ mm. 3rd, 122½ mm. 4th, 102 mm. 5th, 119 mm. 6th, 118 mm.

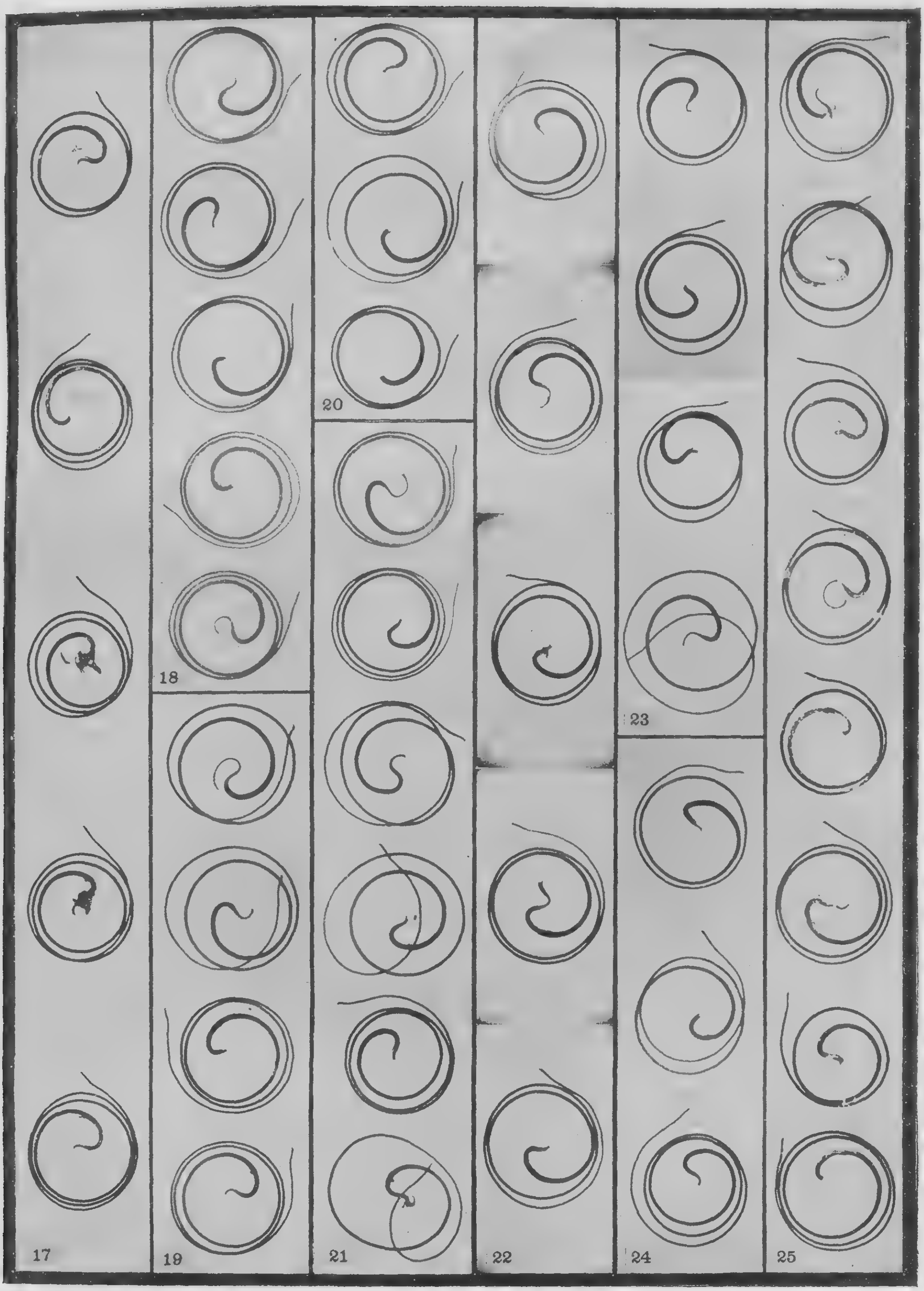
PHOTO 65. Intromittent organ from the male of photo 65, plate 34. Length of intromittent organ, 113½ mm.

PHOTO 66. Intromittent organs from the three males of photo 66, plate 34. Lengths of intromittent organs:—1st (upper), 114½ mm. 2nd, 116½ mm. 3rd, 106½ mm.



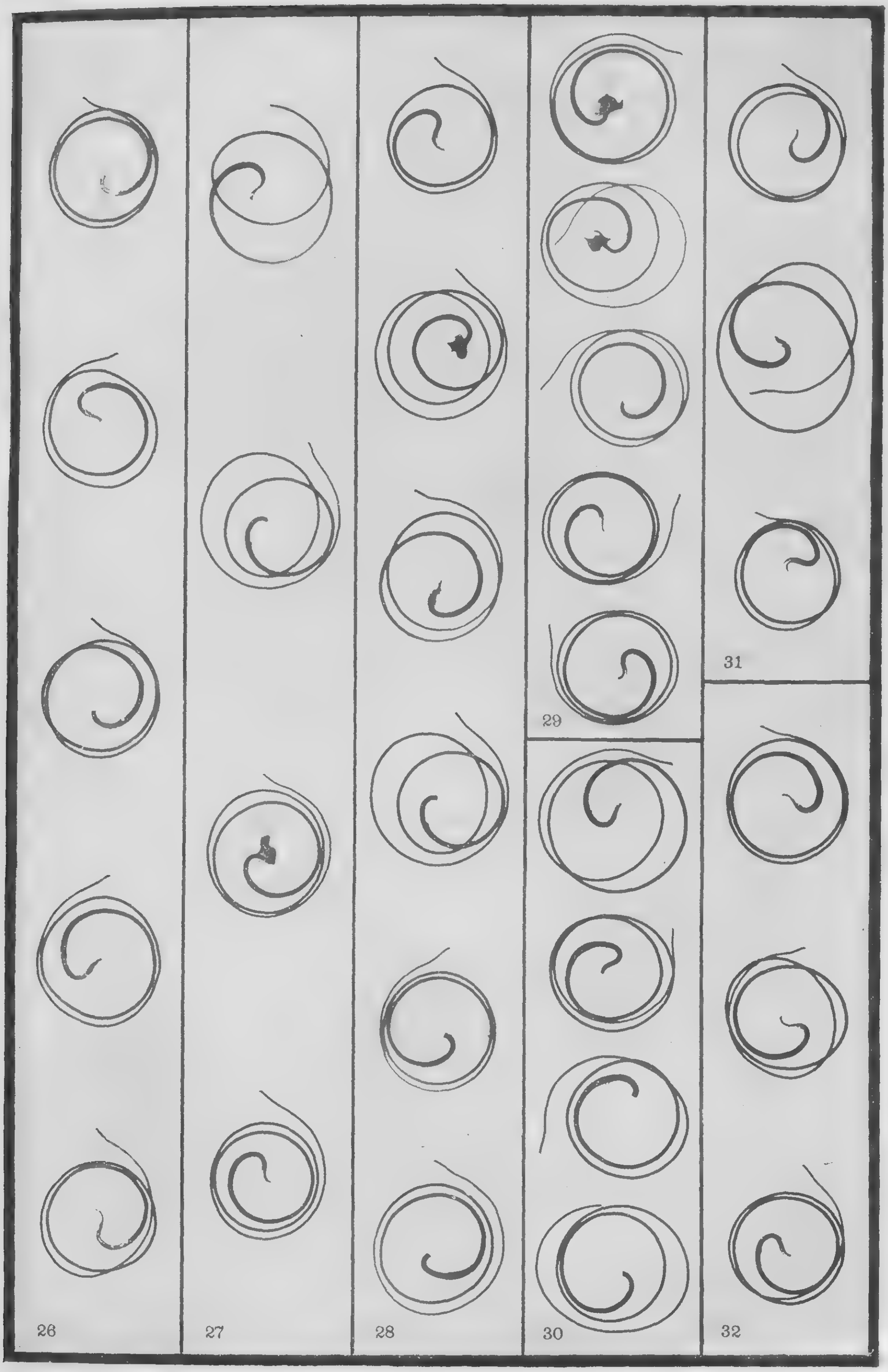
K.F. & E.C.S., photo. Andre, Sleigh & Anglo, Ltd.

INTROMITTENT ORGANS from EUSCHISTUS VARIOLARIUS, E. SERVUS, & HYBRIDS.



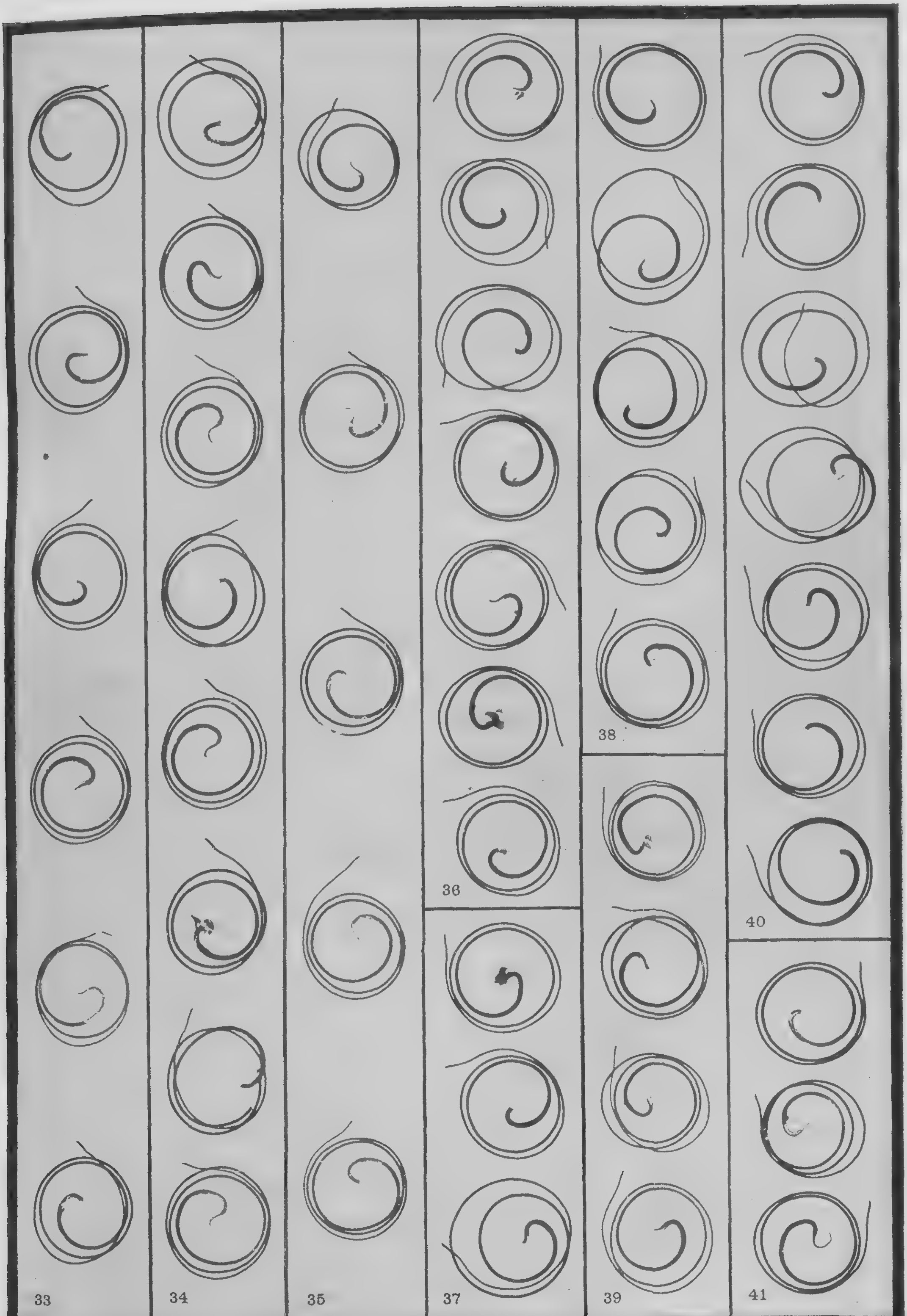
K.F. & E.C.S., photo. Andre, Sleigh & Anglo, Ltd.

INTROMITTENT ORGANS from F_2 HYBRIDS from
E. VARIOLARIUS & E. SERVUS.



K.F. & E.C.S., photo. Andre, Sleigh & Anglo, Ltd.

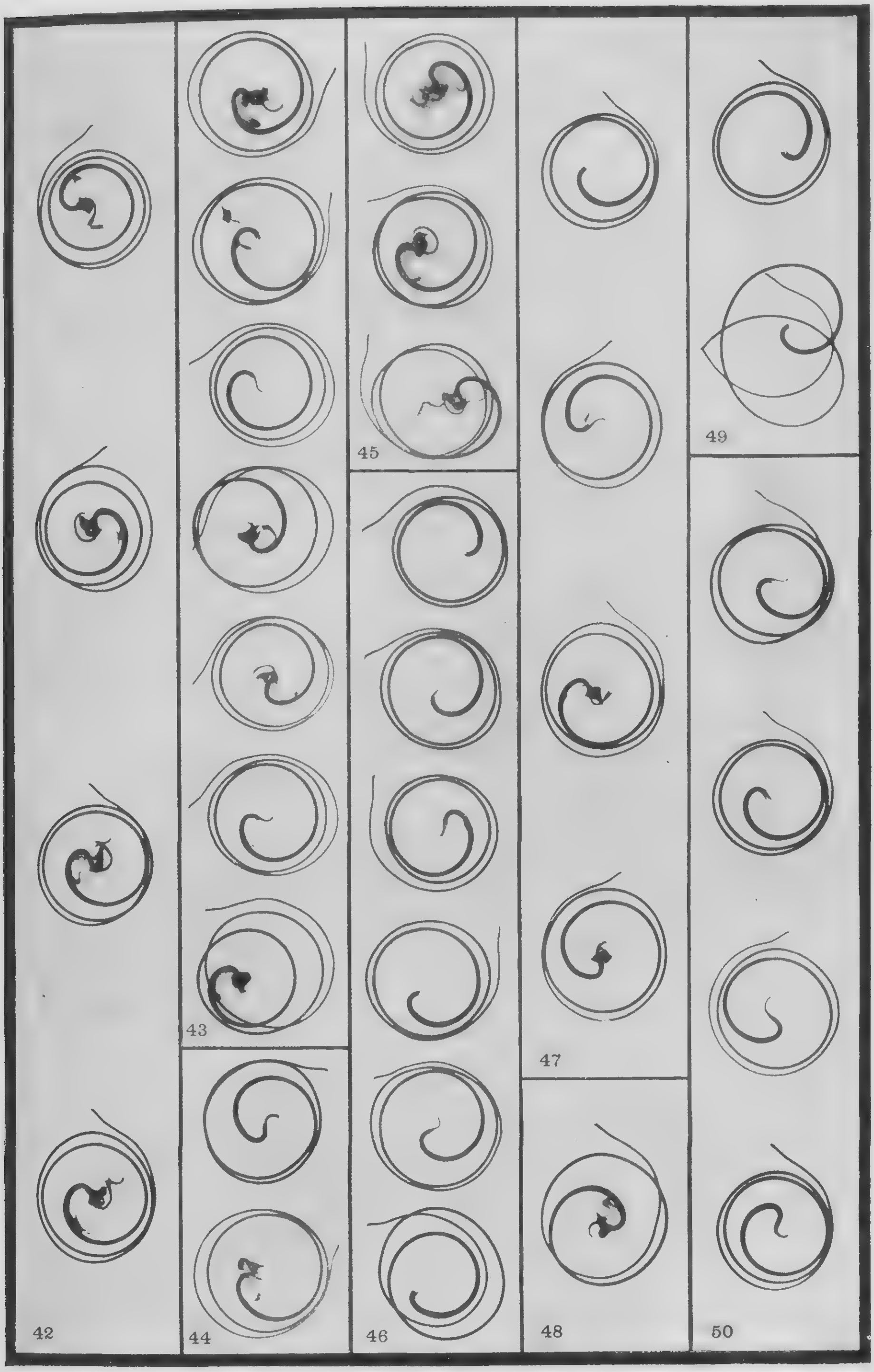
INTROMITTENT ORGANS from F_2 HYBRIDS from
E. VARIOLARIUS & E. SERVUS.



K.F. & E.C.S., photo.

Andre, Sleigh & Anglo, Ltd.

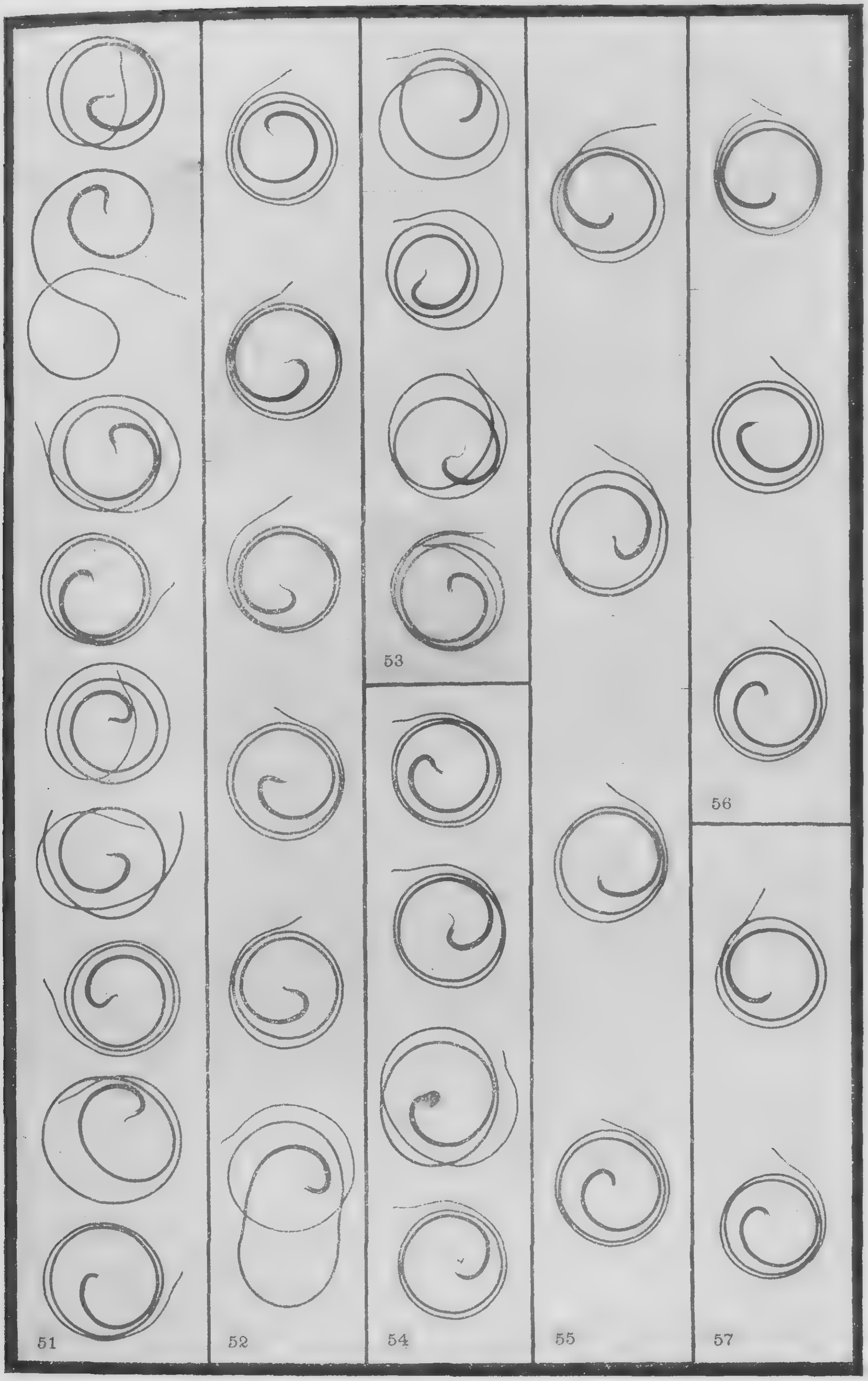
INTROMITTENT ORGANS from F_2 HYBRIDS from
E. VARIOLARIUS & E. SERVUS.



K.F. & E.C.S., photo.

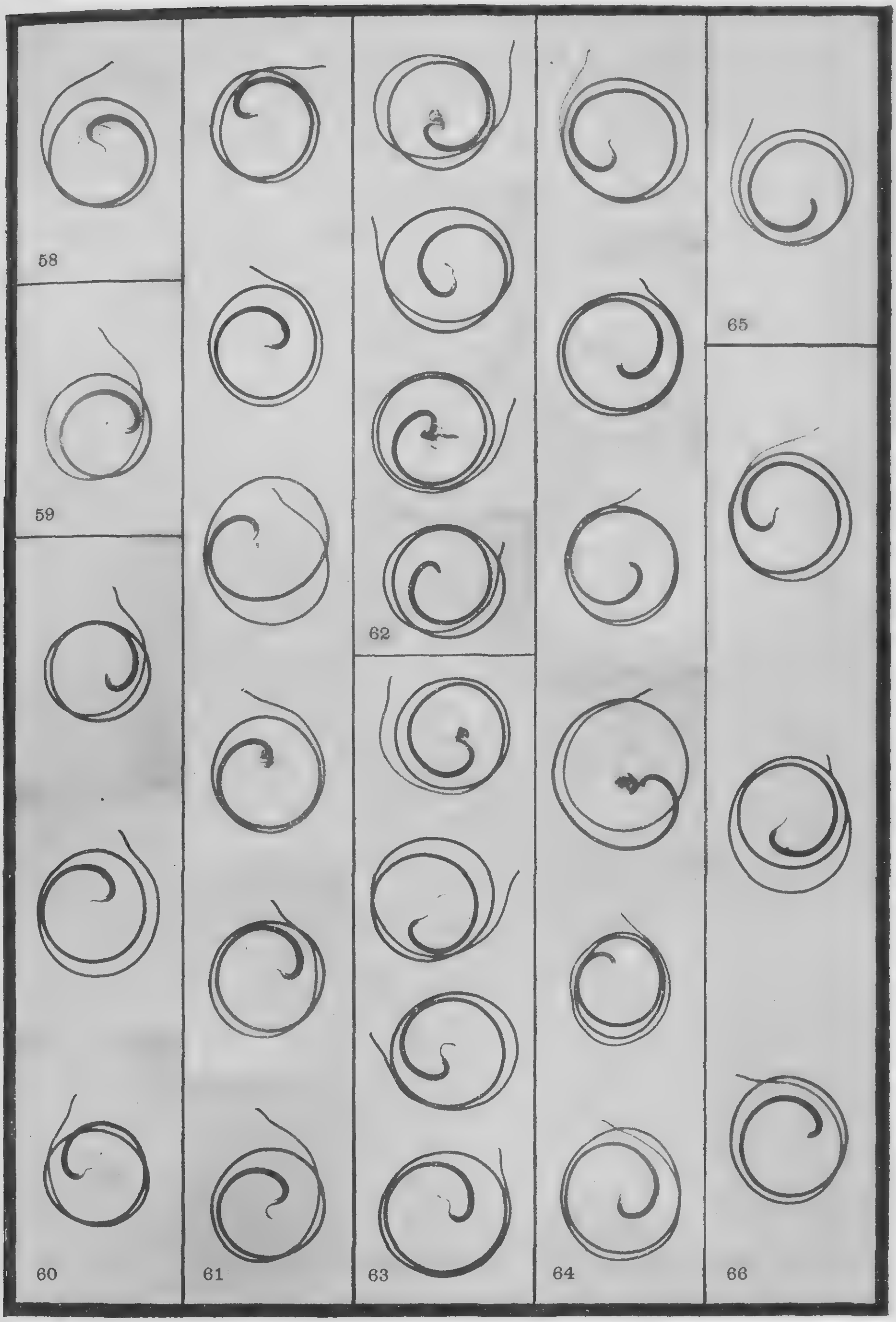
Andre, Sleigh & Anglo. Ltd.

INTROMITTENT ORGANS from F_2 HYBRIDS from
E. VARIOLARIUS & E. SERVUS.



K.F. & E.C.S., photo. Andre, Sleigh & Anglo, Ltd.

INTROMITTENT ORGANS from F_2 HYBRIDS from
E. VARIOLARIUS & E. SERVUS.



K.F. & E.C.S., photo. Andre, Sleigh & Anglo, Ltd.

INTROMITTENT ORGANS from E. VARIOLARIUS MALES & MALES from F_1 ♀ × E. VARIOLARIUS ♂

[*Extracted from the* LINNEAN SOCIETY'S JOURNAL—ZOOLOGY, vol. xxxii. *September* 1914.]

W. A. Lamborn's Breeding Experiments upon *Acræa encedon* (Linn.), in the Lagos District of West Africa, 1910–1912. By EDWARD B. POULTON, D.Sc., F.R.S., Pres.L.S.

[Read 2nd April, 1914.]

THE typical form of *Acræa encedon* is a tawny butterfly with a black, white-barred tip to the fore wing. The pattern thus closely resembles that of the type form of *Danaida chrysippus*, Linn. *A. encedon* is polymorphic in both sexes, and the following forms are referred to in the present memoir:—

Infuscata, Staud., "the tawny areas of the typical forms are replaced by smoky brown" (p. 112 *). This form is transitional in one direction into dark-grey butterflies without any tawny tint, and in the other into dark forms of *encedon*.

Alcippina, Auriv. "The h.-w. has a white central suffusion of varying extent" (p. 212), thus reproducing the pattern of the *alcippus*, Cram., form of *chrysippus* and of transitional varieties between *alcippus* and *chrysippus*.

Daira, Godm. & Salv., "the black of apical half of f.-w. and the white subapical band are absent. In some cases the subapical band may be traced as a slightly paler area on the ground-colour. All the black markings much reduced" (p. 212).

Commixta, Poulton †. This form is a combination of the two preceding, having the central white patch on the hind wing of *alcippina*, and a fore wing approaching that of *daira* in the tint of the subapical bar, which is tawny like the ground-colour. The pattern thus resembles the *albinus*, Lanz, form of *chrysippus*, but the mimetic relationship is not suggested because of the rarity of the model and its restriction to the parts of Africa where *dorippus* is abundant.

Lycia, Fabr. "The ground-colour of both wings is white, the black markings being as in the typical form" (p. 112). "Examples of the *lycia* form may have the ground-colour pale creamy yellow" (p. 213), and are thus transitional towards the *syanzini* form.

Syanzini, Boisd. "The tawny areas of the typical form are replaced by a dusky yellowish colour" (p. 212).

* This description and those of the other forms except *commixta* are quoted from H. Eltringham's great work, "Monograph of the African Species of the Genus *Acræa*,' Trans. Ent. Soc. Lond. 1912, pt. i.

† Trans. Ent. Soc. Lond. 1913, p. 409.

The Geographical Distribution and Mimetic Associations of the forms of Acræa encedon.

The account contained in the following four paragraphs was drawn up by the present writer in 1907 but has not hitherto been published.

Acræa encedon, like the female of *Hypolimnas misippus* (Linn.), presents three forms mimicking the three forms of *Danaida chrysippus* (Linn.), but, being without the extraordinary powers of flight possessed by the Nymphaline co-mimic, their geographical coincidence with the forms of the model is closer. This superiority is particularly interesting in relation to Müllerian mimicry when we remember that the *Acræinæ* are a highly protected group.

In South Africa the predominant form is *encedon*, resembling the predominant *chrysippus*. Dr. Dixey and Dr. Longstaff, from their experience of it in this part of the Region, state that *encedon* was "so successful in its mimicry of *L. chrysippus* as at first to make one of us believe it to be that species".* There is also a black and white form, *lycia*, F., and, even more commonly, a black and yellowish form (*sganzini*, Boisd.) which occur not only here but throughout the East Coast range of *encedon*. Mr. Marshall has recorded that *lycia*, when upon the wing, shows a decided resemblance to the whiter forms of *Acræa esebria*, Hew.†

As we pass northwards, forms with white hind wings (*alcippina*, Auriv.) and forms in which the black and white tip to the fore wing is evanescent (*daira*, Godm. & Salv.), both rare in the South, begin to increase in numbers, intermixed with the type *encedon*. Finally, in British East Africa, all three forms occur commonly, *daira* and *encedon* being most abundant, just as are the corresponding models—the *dorippus*, Klug, and type forms of *D. chrysippus*.

In the West, all forms except *sganzini* occur, but the late Mr. Herbert Druce, F.L.S., received ‡ from a locality in Sierra Leone several specimens of *alcippina*, which seem to show that the *alcippus* form of *D. chrysippus* has here at least produced some effect as a model. The specimens in Mr. Druce's series are not only all *alcippina* but unusually pronounced examples of this form, and beautiful mimics of the tropical West African form of *D. chrysippus*.

H. Eltringham remarks of the distribution of *encedon*: "None of the forms seems to be specially characteristic of any particular locality, though the *alcippina* form seems to attain its maximum development in West Africa" (*l. c.* p. 213). "The *lycia*, *alcippina*, and *infuscata* forms are more numerous in West African localities than elsewhere, though they seem liable to occur elsewhere" (p. 211).

* Trans. Ent. Soc. Lond. 1907, p. 318; also p. 328. See also p. 321 for the converse mistake, viz. of model for mimic.

† Trans. Ent. Soc. Lond. 1902, p. 479.

‡ Trans. Ent. Soc. Lond. 1902, p. 480. The *daira* form is *extremely* rare in the West.

Since the appearance of Eltringham's monograph much evidence has accumulated proving beyond doubt the strong development of the white-hind-winged *alcippina* form in the interior of Sierra Leone, from which area it is probably continuous into N. Nigeria. The following list of examples of *alcippina* and its model *alcippus*, recently received by the British Museum of Natural History, has been kindly prepared by Mr. N. D. Riley, F.E.S. The extraordinary predominance of the female *alcippina* over the male—50 to 5—strongly suggests the prevalence of all-female families such as Mr. W. A. Lamborn finds in the Lagos district.

Dated examples of Danaida chrysippus, f. alcippus, *and* Acræa encedon, f. alcippina *in the British Museum, from Sierra Leone and N. Nigeria.*

		D. chrysippus, f. alcippus.		A. encedon, f. alcippina.	
I.—SIERRA LEONE. Collected by J. J. Simpson.					
Kambia.	24. iii. 1912.	14♂	—	—	—
Bassia.	25. iii. „	5♂	—	—	—
Kokona.	26. iii. „	5♂	—	—	—
Yana.	30. iii. „	1♂	—	—	—
Laminaia	23–25. iv. „	1♂	—	—	—
Port Lokko.	9–11. v. „	1♂	1♀	—	—
Batkam.	15–18. v. „	8♂	5♀	—	—
Kafogo.	23. v. „	5♂	2♀	—	1♀
Kaballa.	27. v. „	4♂	—	—	1♀
Benikoro.	30. v. „	—	—	—	1♀
Falaba.	1. vi. „	—	1♀	—	1♀
Tirikoro.	15–17. vi. „	—	—	1♂	1♀
Keneura.	20. vi. „	—	—	—	1♀
Bumbanya.	22. vi. „	1♂	—	—	—
Johanna.	28. vi. „	1♂	—	—	—
Giema.	6. viii. „	—	—	1♂	—
Jowati.	19. viii. „	—	—	—	1♀
Gigbema.	22. viii. „	—	—	1♂	38♀
Bo.	1. ix. „	4♂	3♀	—	—
Mafwe.	7. x. „	5♂	—	—	2♀
II.—N. NIGERIA. Collected by G. T. Fox.					
Panyam.	2. vi. 1910.	—	2♀	—	—
(Banchi Prov.).	3. vi. „	—	—	1♂	1♀
	4. vi. „	—	1♀	1♂	1♀
	31. vii. „	—	—	—	1♀
	13. viii. „	1♂	—	—	—
Totals		56♂	15♀	5♂	50♀

In addition to the above, the British Museum Collection contains a single undated female *alcippina* from Panguma, N. Nigeria, another undated female from 70 miles up the river from Freetown, Sierra Leone, and an undated male from Liberia.

The predominant development of *alcippina* in Sierra Leone will be rendered evident by the following list of the other West African forms of *encedon* in the British Museum, also prepared by Mr. N. D. Riley, together with all West African forms, including *alcippina,* in the Hope Department, Oxford, and the Tring Zoological Museum :—

LOCALITIES AND MUSEUMS. I. British Museum. II. Hope Department.[1] III. Tring Museum.		*encedon.*	*encedon infuscata.*	*infuscata.*	*alcippina.*	*daira.*	*commixta.*	*lycia.*
Gambia River ...	III.							1♂ 2♀
Sierra Leone	I.			1♂[2]			2♂ 2♀	4♀
	II.				1♀[3]			1♂ 1♀
	III.				1♀			3♀
Gold Coast	I.							1♂
Nigeria, N. & S....	I.			2♂ 20♀		1♂[4]	3♂ 1♀	5♂ 17♀
	II[5].		1♂	7♂ 2♀[6]	1♂[7]		1♂ 1♀	7♂[8] 5♀
	III.							2♀
Cameroons	I.	1♂		1♀				
	III.				1♀			
Congo State	I.	2♀[9]						
	II.		2♀	2♂[10]				2♂
	III.		2♂ 7♀		1♀			1♂ 1♀
Angola	I.	1♀						1♀
	II.		1♀					
	III.		21♂[11] 6♀					7♂ 3♀
Totals		1♂ 3♀	24♂ 16♀	12♂ 23♀	1♂ 4♀	1♂	6♂ 4♀	25♂ 39♀

[1] Including a few specimens from the collections of M. Charles Oberthür and of the Luxembourg Museum, which I have had the opportunity of studying at Oxford.

[2] Transitional towards *lycia*.

[3] Port Lokkoh : 1912 : Mrs. Addison.

[4] The type of the form, from Lower Niger.

[5] Not including the captured parents of any of the families tabulated on pp. 407, 409–414.

[6] The ♀♀ very dark : one ♂ with a fulvous f.-w. bar.

[7] Ibadan, S. Nigeria : May 1910 : Rev. Lake S. Noble.

[8] Included in the 7♂♂ is an injured specimen of which the sex is not quite certain.

[9] One ♀ is the type of "*fulva,*" Doubl., Westw., and Hew.

[10] Very dark specimens

[11] One ♂ transitional towards *alcippina.*

The relative proportion of males and females suggests the prevalence of all-female families, especially in Nigeria. The figures from Old Calabar, included in the Nigerian totals from the British Museum (I.), are remarkable :—18 ♀ *infuscata*, 1 ♀ *commixta*, 14 ♀ *lycia*.

The two lists confirm Eltringham's conclusions as to the West African forms quoted on p. 392. The second list also shows the excessive rarity of *daira*, the predominance of *lycia*, and, next to it, *infuscata* and *infuscata-encedon*, followed by *commixta*. The two lists together show that *alcippina* is rare except in Sierra Leone.

The nearest approach to the proportion of the *encedon* forms on the West coast, S. of Sierra Leone, is to be found in Madagascar, where the pale form *sganzini* is predominant like the still paler *lycia*, and a dark dull form of *encedon* represents *infuscata*. The Madagascan *sganzini* are transitional into a cream-coloured *lycia*. I have not seen any form from Madagascar except those above-named and intermediates between them.

In the Hope Department there are 15 ♂ and 3 ♀ of *sganzini* (1 ♂ might be called a cream-coloured *lycia*), and 6 ♂ 1 ♀ of *encedon-infuscata* (1 ♂ showing transition towards *sganzini*) ; in the Tring Museum 9 ♂ and 1 ♀ of *sganzini* ; in the British Museum 4 ♂ and 1 ♀ of *sganzini* ; in the Luxembourg Museum 1 ♂ and 1 ♀ of *sganzini* and 1 ♂ transitional between *sganzini* and *infuscata*.

On the opposite East coast of the continent the pale forms are chiefly *sganzini*, like Madagascar, but their proportion is very different, being much less than that of *encedon*. Thus there are 15 *encedon* and 4 *sganzini* from Natal in the Hope Department. The *lycia* of the West is replaced by the yellower *sganzini*, somewhere about the Rift Valley, in British East Africa.

The much larger amount of material now available supports the conclusions, arrived at in 1907 (p. 392), as to the geographical relationship between certain forms of *encedon* and those of *D. chrysippus*. The form *daira* is common where *dorippus* is common, and becomes rare where *dorippus* is rare or wanting : the typical, brightly coloured *encedon* is predominant where the type form of *chrysippus* prevails : the only locality where *alcippina* is abundant is part of the area over which *alcippus* displaces every other form of *D. chrysippus*. Mimicry occurs in both sexes, although the female, at least in the *encedon* form, is a better mimic than the male, partly on account of its larger size but also because of the whiter subapical bar to the fore wing.

The Forms of Acræa encedon *in the Locality of the Breeding Experiments.*

The following specimens, captured by Mr. W. A. Lamborn in the Oni district, about 70 miles east of Lagos, are included in the Table on p. 394. From Oni : 1 ♂ 2 ♀ *lycia*, 1 ♀ *infuscata* ; from Idakun, 4 miles N.W. of Oni: 4 ♂ *infuscata*, 1 ♂ 1 ♀ *commixta*, 1 ♂ 1 ♀ *lycia*. To these must be added

the captured parents of Families 1, and 3–16, recorded on pp. 407, 409–414, viz. 2 ♂ 7 ♀ *lycia*, 1 ♂ 3 ♀ *infuscata*, 1 ♀ *commixta*, from Oni; 1 ♂ 1 ♀ *lycia*, 1 ♀ *infuscata*, from Idakun. The totals from the Oni district are therefore 16 *lycia* (5 ♂ 11 ♀), 10 *infuscata* (5 ♂ 5 ♀), and 3 *commixta* (1 ♂ 2 ♀).

The artificial conditions produced no apparent effect, the *lycia*, *infuscata*, and *commixta* of the breeding experiments being similar to the captured specimens of the same forms. The families were examined by Eltringham, who states that "the majority . . . . consist of two forms, viz. *infuscata* and *lycia*. The latter are somewhat unusual in having broad suffused orange internervular markings on the hind margin of the secondaries on the under side, also some basal markings of the same colour" (*l. c.* p. 213). It is also noticeable that the males of these Southern Nigerian *lycia* are distinctly yellower than their females, and that the subapical bar of the fore wing in the *infuscata* forms is yellow in the male, white in the female. Lamborn concludes that *lycia* is certainly three and probably four times as numerous as *infuscata* in the neighbourhood of Oni, and his material shows that *commixta* is much rarer than *infuscata*. He did not meet with any other form except these three, nor did any other appear in his long series of breeding experiments.

Tabular Statement of W. A. Lamborn's Breeding Experiments (pp. 397–8).

It will be observed that Companies 5 and 7, together with Family 8, suggest that *lycia* and not *infuscata* is dominant, a conclusion rendered improbable by the rest of the figures. These 3 sets, together with Family 7, are probably to be explained by comparison with Families 4 and 13. The *lycia* ♀ parents of these two families laid eggs in two batches, which were kept distinct, and the larvæ reared separately. Both families as a whole yield approximate equality of *infuscata* and *lycia*, but the constituent batches depart widely from this ratio. The 4 irregular results referred to above are all manifest in relatively small numbers, and they may be fairly referred to the causes which produced the constituent batches of Families 4 and 13.

The inferences as to the Mendelian constitution of the parents were submitted to my friend Mr. L. Doncaster, who has had so wide an experience in this line of research. He kindly wrote, April 16, 1913:—

"I think *lycia* must be recessive in spite of the inverted 3 : 1 cases, because of Family 2. Both parents were from Company 4, and if *lycia* were dominant all the *lycia* individuals would presumably be heterozygous. I think all your inferences as to parentage are correct."

Mr. Doncaster also remarks:—"It is a pity there are no known cases of *infuscata* ♀ × *lycia* ♂ and *vice versa*, which would test whether the *infuscata* character is sex-limited in the ♀; but as none of the mixed families have all the ♂ ♂ *infuscata* and ♀ ♀ *lycia*, it does not seem likely."

The results of breeding the Wild Larvæ, the Companies, and Families 1–3 have been recorded in Proc. Ent. Soc. Lond. 1911, pp. liv–lvi, before the appearance of Eltringham's monograph, containing a thorough account of all the forms of *A. encedon*. The darker forms found and bred at Oni, named *encedon* in the 1911 publication, are now recognised as *infuscata*, and a few as *commixta*.

Source of the Broods, with the forms of the parents when known.	*INFUSCATA*, with a few *COMMIXTA*.		*LYCIA*.		Inferred Mendelian constitution of the Parents. Remarks.
	Male.	Female.	Male.	Female.	
Wild Larvæ (1)	6	8	5	26	Two ♂♂ & 1 ♀ *commixta* and 1 transitional ♂ are included among the *infuscata*. The 27 latest emergences were all ♀.
„ „ (2)	...	17	3	18	One ♀ *commixta* is included among the *infuscata*. The 3 ♂♂ appeared with 2 ♀♀ in the 5 latest emergences.
Company 1	...	...	46	32	Both parents recessive (*lycia*). Two ♂♂ approach *commixta*.
„ 2	...	24	...	23	One parent heterozygote (*infuscata*), the other recessive (*lycia*).
„ 3	...	35	...	...	One parent dominant (*infuscata*), the other either dominant, heterozygote (*infuscata*), or recessive (*lycia*).
„ 4	6	2	4	1	One parent heterozygote (*infuscata*), the other recessive (*lycia*).
„ 5	...	6	...	16	The proportions, suggesting heterozygote *lycia* for both parents, are more probably due to a special batch of ova. (See Fams. 4 & 13.)
„ 6	...	...	3	3	Both parents recessive (*lycia*).
„ 7	2	1	7	6	Inference as in Co. 5.
Fam. 1. ♂♀ *lycia*	...	...	...	48	Both parents recessive.
„ 2. ♂♀ *lycia* fr. Company 4...	...	...	19	13	Both parents recessive. One ♂ approaches *commixta*.
„ 3. ♀ *infuscata* ...	5	11	6	13	The ♀ parent heterozygote, the ♂ recessive (*lycia*).
„ 4. ♀ *lycia*	..	33	...	36	The ♀ parent recessive, the ♂ heterozygote (*infuscata*). Eggs in 2 batches, yielding very different proportions.
„ 5. ♂♀ *infuscata* ...	...	28	...	...	One parent dominant, the other dominant or heterozygote. ♀ parent with fulvous subapical bar inherited by 13 offspring, of which 2 approach *commixta*.

Source of the Broods, with the forms of the parents when known.	*INFUSCATA*, with a few *COMMIXTA*. Male.	Female.	*LYCIA*. Male.	Female.	Inferred Mendelian constitution of the Parents. Remarks
Fam. 6. ♀ *infuscata* ...	...	21	...	21	The ♀ parent heterozygote, the ♂ recessive (*lycia*). A single ♂ *lycia*, perhaps accidentally introduced, is not included.
,, 7. ♀ *commixta* ...	...	3	...	9	The 3 ♀♀ in 2nd column are *commixta*. Inference as in Co. 5: 2 heterozygote *lycia* parents are here excluded.
,, 8. ♀ *lycia*	...	7	...	21	Inference as in Co. 5.
,, 9. ♀ *lycia*	...	1	...	1	The ♀ parent recessive, the ♂ heterozygote (*infuscata*).
,, 10. ♀ *lycia*	...	...	...	12	Both parents recessive (*lycia*).
,, 11. ♀ *infuscata* ...	...	12	...	14	The ♀ parent heterozygote, the ♂ recessive (*lycia*).
,, 12. ♀ *lycia*	...	...	...	41	Both parents recessive (*lycia*).
,, 13. ♀ *lycia*	...	45	...	42	The ♀ parent recessive, the ♂ heterozygote (*infuscata*). Eggs in 2 batches, yielding different proportions.
,, 14. ♂ ♀ *lycia*	...	...	...	19	Both parents recessive.
,, 15. ♂ ♀ *lycia*	...	...	...	19	,, ,, ,,
,, 16. ♂ ♀ *lycia*	...	...	12		,, ,, ,,
,, 17. ♂ ♀ *lycia*	...	...	...	34	,, ,, ,,
,, 18. ♂ ♀ *lycia*	...	...	...	11	,, ,, ,,
,, 19. ♂ ♀ *lycia*	...	...	24	16	,, ,, ,,
,, 20. Parents unknown	...	35	...	36	One parent heterozygote (*infuscata*), the other recessive (*lycia*).
,, 21. ,, ,,	16	5	...	...	One parent dominant (*infuscata*), the other dominant, heterozygote (*infuscata*), or recessive (*lycia*).
TOTALS	35	294	129	539	

Segregation into infuscata, commixta, *and* lycia.

Looking at the 998 bred specimens * as a whole, it is remarkable how completely they segregate into *infuscata*, *commixta*, and *lycia*, and how few specimens can be considered as intermediate between these. Those that did

* Including the single ♂ which appeared in Family 6.

appear are transitional between *commixta* and *infuscata* on the one side, and *commixta* and *lycia* on the other, rather than directly between the two chief forms. Hence, by selecting the examples, a fair transition from *infuscata* to *lycia* may be constructed by way of *commixta*. This latter form is clearly hereditary. Thus the female parent of Family 7 is *commixta*, and all 3 of her non-*lycia* offspring are *commixta*. Particularly interesting in this respect is Family 5, of which the female parent possesses the fulvous bar but not the white hind wing of *commixta*. About half of the offspring, namely 13 out of 28, resemble the mother in this respect *, while 2 of them have also the white hind wing. Other evidence of the hereditary transmission of this combination of characters will be found under Family 2 (pp. 407–8).

Families of which the female parent only is known.

When the only known parent is a female *infuscata* (or *commixta*) the offspring show, in all four families, a mixture of *infuscata* (or *commixta*) and *lycia* with approximate equality three times. In the single exception, Family 7, the numbers are small. The inference is that one parent was recessive and the other heterozygote.

When the only known parent is a female *lycia*, the offspring are all *lycia* twice and mixed *lycia* and *infuscata* four times, with equality thrice (including the small Family 9) and irregularity once (Family 8).

In the absence of selective breeding, for which there is insufficient evidence, the great numerical superiority of *lycia* would result in the majority of the pairings being between males and females of this form, or between *lycia* and *infuscata*, the latter being far more commonly heterozygote than pure dominant. We can thus, on the hypothesis that *lycia* is recessive, understand why the families bred from a female of this form were either all *lycia* or mixed *lycia* and *infuscata*, but, owing to the relative rarity of the pure dominant, never, in the author's experience, entirely made up of heterozygotes bearing the appearance of the dominant (*infuscata*). It is unfortunate that the *infuscata* in the families with equal numbers of the two forms never happen to have been bred from, so that their heterozygote constitution could be tested.

Families of which both parents are known.

Both male and female are of the form *lycia* in 8 families ; both are of the form *infuscata* in only 1, namely Family 5. The 8 former produced only *lycia* offspring ; the latter only *infuscata*.

* The numbers suggest that, as regards this character, the parents were recessive and heterozygote respectively. If this be so, the female, belonging to the rarer form, was probably heterozygote, while *infuscata*, although dominant in relation to *lycia*, is recessive to the form with a fulvous bar.

The fact that 2 *lycia* parents should 8 times have produced offspring which were nothing but *lycia* strongly supports the view that this form is recessive. It is unfortunate that there was only a single family with *infuscata* parents, and that this one should have failed to afford evidence as to the dominance of the latter form.

Companies and Families with equality of infuscata *and* lycia.

The frequency with which there is exact or approximate equality between the two forms is striking. Omitting very small numbers, we notice conspicuous instances in Company 2, Families 3, 4, 6, 11, 13, & 20. It is to be observed that Family 3 is the only one of these that is not all-female.

The female parents of these groups, so far as they are known, are *infuscata* 3 times (Families 3, 6, & 11) and *lycia* twice (Families 4 & 13).

The Proportion of the all-female Companies and Families and of the Sexes in the mixed groups.

The two series bred from Wild Larvæ are omitted from these considerations because of the uncertainty which naturally attaches to them, although it must be remembered that there are good reasons for believing that the great majority of each set belonged to a single all-female family.

Three out of the 7 companies, and 16 out of the 21 families, are made up of all-female offspring. On the other hand, there are almost precisely 50 per cent. more males than females in the mixed sets. In 3 out of 4 companies with mixed sexes, the males are more numerous ; in the 4th (the very small Company 6) the numbers are equal (3 of each sex). The totals in these mixed companies are 68 males and 45 females, and in the 5 mixed families 82 males and 56 females. In this latter series there is also one exception, and a very marked one, namely, Family 3 with 11 males and 24 females. The totals, in all mixed companies and families, are 150 males and 101 females.

Relationship between the all-female and the mixed Families.

It is important to notice that the male parents may produce very definite hereditary effects upon their female offspring in the all-female families. Thus the Mendelian relationship between the forms of parents and offspring appears to be the same in all-female families as in those with mixed sexes.

It is quite clear that the all-female families bear no special relation to one of the local forms of *Acræa encedon* rather than another. They may be all *infuscata* or they may be all *lycia*, or approximately half *infuscata* and half *lycia*.

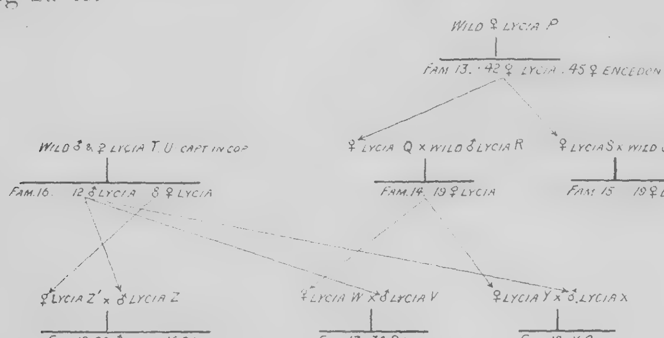
Considering the 19 all-female groups among the companies and families, 2 are all *infuscata* (the known parents of one being ♂ ♀ *infuscata*), 7 are all *lycia* (the known parents ♀ *lycia* twice, ♂ ♀ *lycia* five times), and 10 are mixed *infuscata* or *commixta* and *lycia* (the known parents ♀ *infuscata* twice, ♀ *commixta* once, and ♀ *lycia* four times).

Seven out of the 10 mixed groups are exactly or approximately half *infuscata* and half *lycia*. The remaining three are Company 5 with 6 *infuscata* to 16 *lycia*, Family 7 with 3 to 9, Family 8 with 7 to 21. It is rather curious that the proportions are here—exactly in the 2 families and approximately in Company 5—the Mendelian expectation if *lycia* were dominant and 2 heterozygotes had paired: an interpretation untenable for Family 7, of which the ♀ parent was not *lycia*. The probable explanation of these irregularities and that exhibited by Company 7 has been suggested on p. 396.

Among the 9 groups with mixed sexes, out of the 28 companies and families, 1 is all *infuscata* (parents unknown), 5 are all *lycia* (known parents ♂ ♀ *lycia* three times), and 3 are mixed *infuscata* and *lycia* (known parent ♀ *infuscata* once). Of these 3, Company 7 with 3 *infuscata* to 13 *lycia* is considered above, while the other two give approximate equality (Family 3) and probably rough equality (Company 4).

Probable existence of two strains of females, one producing all-female, and the other male and female families.

It will be observed in the Table on pp. 397–8 that Family 2 with mixed sexes was produced by a male and female *lycia* from Company 4 also made up of males and females. These facts favour the conclusion that the power of producing mixed sexes is hereditary. Confirmation is also provided by the offspring of Family 16, with mixed sexes, bred from a pair of *lycia* captured in the wild state. From two of these offspring sprang Family 19, also of mixed sexes. The relationship between Families 16 & 19 is shown in the following Table.



The existence of a strain producing nothing but females is supported by stronger evidence; for the breeding experiments extended over 3 generations, also set forth in the accompanying Table. In this we see that two males from the mixed Family 16, paired with females from the all-female Family 14, produced nothing but females in the resulting Families 17 and 18. Another male from Family 16, paired with a female from the same family, produced, as stated above, the mixed Family 19.

Although further evidence is desirable, the whole of Mr. Lamborn's experiments, so far as they bear on this subject, point in one direction. There are no grounds for the belief that parthenogenesis ever takes place in this species, but the determination whether the family is to be all-female or mixed rests solely with the female parent.

W. A. Lamborn's Breeding Experiments.

Wild Larvæ.—Two sets of wild larvæ collected on *Commelina* were bred, and it will be seen that there are indications of an all-female company in the later emergences of the first set and in all except the very latest emergences of the second.

Wild Larvæ 1.

These larvæ were collected in Googa Creek, about five miles north of Oni. Their whole life-history fell well within the wet season, which lasted from about April 25 to Nov. 15, 1910. The dates of emergence and some of the dates of pupation are shown in the following Table :—

Dates of Pupation. 1910.	Dates of Emergence. 1910.	*infuscata* and *commixta*.		*lycia*.	
		Male.	Female.	Male.	Female.
June 19.	June 26.		1		
„ 21.	„ 27.		1		
„ 20.	„ 27.		1		
„ 22.	„ 28.		1		
—	„ 30.	1			
„ 28.	July 4.	1			
—	„ 5.			1	
—	„ 6.				1
—	„ 7.	4	1	4	1
—	„ 8.				2
—	„ 9.		1		5
—	„ 10.				3
—	„ 11.		2		4
—	„ 12.				7
—	„ 13.				3
—	Totals	6	8	5	26

Three *commixta* are included in the series of *infuscata*, namely, 2 males emerging July 7 and 1 female emerging July 9. *Commixta* possesses a fulvous fore-wing subapical bar with a white hind wing, approaching that of the form *alcippina*. One other male of July 7 has the former of these characters only, and is thus transitional. Some *lycia* of this series also exhibited a slight suffusion of the fore wing with a fulvous tint.

Wild Larvæ 2.

The larvæ were collected on the bank of Oni River, about two miles north-west of Oni. Their whole life-history fell within the dry season, which lasted from about mid-Nov. 1910 to mid-March 1911. The dates of emergence are shown in the following table.

Dates of Emergence. 1910.	*infuscata* and *commixta*.		*lycia*.	
	Male.	Female.	Male.	Female.
Dec. 10		3		4
" 11				3
" 14		4		1
" 15		8		6
" 16		1		1
" 17				1
" 21		1		
" 23			1	2
" 24			2	
Totals		17	3	18

One female *commixta*, emerging Dec. 10, is included in the series of *infuscata*. The hind wing is whiter than in most other examples—so much so, indeed, that the specimen might, except for the fulvous fore-wing bar, be fairly classed under the form *alcippina*.

Companies :—The following 7 companies of larvæ were bred each from a batch of eggs laid on a single leaf of the food-plant *Commelina*, by the Oni River, about two miles north-west of Oni Camp. Great care was taken

to ensure that the larvæ of each company should be kept separate. The eggs themselves formed in each case a clump no larger than a threepenny-bit, and it may be assumed that each was laid by a single female. The dates at which some of the batches of ova were found were not preserved, but all of them fell into Dec. 1910 or Jan. 1911, and therefore well within the dry season, which extended from about mid-Nov. 1910 to mid-March 1911.

Company 1.

The eggs hatched Dec. 24, 1910. The 2 imagines which emerged on Jan. 21 pupated on Jan. 16. The other dates of pupation were not preserved.

The eggs produced both males and females, all of the form *lycia*, which emerged on the following dates :—

Dates of Emergence. 1911.	*lycia.*	
	Male.	Female.
Jan. 21	2	
„ 22	3	
„ 23	17	2
„ 24	1	
„ 25	18	8
„ 26	5	18
„ 28		3
„ 29		1
Totals	46	32

The individuals of this company are unusually dark, and in many specimens, principally males, the basal half of the fore wing is suffused with a faint fulvous tint varying in depth of shade. In the most extreme of these the fore wing may be called intermediate between *infuscata* and *lycia*. The two varieties in which the suffusion is most pronounced are males, emerging respectively on Jan. 23 and 25. In both of these the subapical bar of the fore wing is of a deeper shade than usual, so that these specimens approach the form *commixta*.

Company 2.

Eggs were found Dec. 24, and hatched Dec. 27.

The eggs produced 47 females, made up of nearly equal numbers of *infuscata* and *lycia*, which emerged on the following dates:—

Dates of Emergence. 1911.	Female *infuscata.*	Female *lycia.*
Jan. 30	4	4
,, 31	2	1
Feb. 1	2	3
,, 2	10	12
,, 3	2	2
,, 4	4	1
Totals	24	23

Company 3.

Eggs were found Jan. 1, and hatched Jan 3.

The eggs produced 35 females of the form *infuscata*, which emerged on the following dates:—

Dates of Emergence. 1911.	Female *infuscata.*
Feb. 1	2
,, 2	11
,, 3	9
,, 4	4
,, 5	3
,, 6	6
Total	35

Company 4.

Eggs were found Jan. 1, and hatched Jan. 3.

The eggs produced males and females of both *infuscata* and *lycia* :—

Dates of Emergence. 1911.	*infuscata.*		*lycia.*	
	Male.	Female.	Male.	Female.
Feb. 14	4		2	
„ 15	1		0	
„ 17		1	1[1]	1[2]
„ 18	1			
„ 19		1	1	
Totals	6	2	4	1

[1] Parent C, of Family 2 (p. 407).
[2] Parent D, of Family 2 (p. 407).

The individuals of this company were typical and uniform, with the single exception of the male parent, *lycia*, of Family 2, in which the basal half of the fore wing was slightly tinged with fulvous, a variation which appeared in many of its offspring.

Company 5.

The dates of capture and hatching were not kept.

The eggs produced 22 female offspring, of which 6 were *infuscata* and 16 *lycia* :—

Dates of Emergence. 1911.	Female *infuscata.*	Female *lycia.*
Feb. 21	1	
„ 22		1
„ 23		4
„ 24	5	11
Totals	6	16

Company 6.

The eggs hatched Jan. 28, 1911.

The eggs produced 3 males of the form *lycia*, which emerged on March 2 and 3 female *lycia* which emerged on March 2, 3, and 4, respectively.

Company 7.

The eggs hatched Feb. 1, 1911.

The eggs produced males and females both of *infuscata* and *lycia*:—

Dates of Emergence. 1911.	*infuscata.*		*lycia.*	
	Male.	Female.	Male.	Female.
March 11			4	
,, 13	1		3	
,, 16				1
,, 18				5
,, 19	1	1		
Totals	2	1	7	6

FAMILIES.—We now come to the series of 21 Families, in 19 of which either the female parent or both parents are known.

Family 1.

Parents A and B, both of the form *lycia*, were captured *in cop.* by the river at Idakun, 4 miles north-west of Oni, Dec. 1, 1910. The male A died Dec. 4. Eggs were laid on the back of a leaf, Dec. 2, and the female parent B was killed Dec. 4. The eggs had all hatched by Dec. 9.

The eggs produced 48 female offspring, all of the form *lycia*, which emerged at the dates shown in the following table. The dates of pupation are also included :—

Dates of Pupation. 1911.	Dates of Emergence. 1911.	Female *lycia*.
Jan. 1.	Jan. 7.	25
,, 2.	,, 8.	12
,, 3.	,, 9.	8
,, 4.	,, 10.	3
	Total	48

Family 2.

Parents C and D both of the form *lycia* (but it has already been pointed out on p. 406 that the male was slightly suffused with fulvous). Both parents belonged to Company 4, and both emerged and paired on Feb. 17. Eggs were laid Feb. 18.

The eggs produced both males and females of the form *lycia* :—

Dates of Emergence. 1911.	*lycia.*	
	Male.	Female.
March 27	5	1
,, 28	12	11
,, 29	2	1
Totals	19	13

The effect of the male parent was obvious in many specimens, especially in a male emerging March 27, which exhibits the same tendency in higher degree, and approaches *commixta*, like the 2 males of Company 1 (see p. 404). It must be remembered, however, that these two latter differ in other respects, belonging, as they do, to an exceptionally dark series.

Family 3.

Parent E. The female parent, of the form *infuscata*, was captured on the river-bank at Idakun. Eggs were laid Feb. 9–10 and hatched Feb. 13–14. The female parent died Feb. 10.

The eggs produced males and females both of *infuscata* and *lycia*, which emerged on the following dates :—

Dates of Emergence. 1911.	*infuscata.*		*lycia.*	
	Male.	Female.	Male.	Female.
March 18	1			
,, 20	....	2	1	
,, 21	1	3	1	1
,, 22	1	1	2	
,, 23	1	3	2	1
,, 24	....	....	....	4
,, 25	....	....	....	4
,, 26	....	1		
,, 27	....	1	....	2
,, 29	1	....	....	1
Totals	5	11	6	13

Family 4.

Parent F. The female parent, of the form *lycia*, was captured in Oni clearing near the lagoon. Two batches of eggs were laid with a day's interval. The first batch began to hatch on Sept. 6, and pupation commenced on Oct. 5.

The eggs of the first batch produced 51 all-female offspring, of which 29 were *infuscata* and 22 *lycia*. One *infuscata* emerged Oct. 12 and the remaining butterflies from this day onwards, but precise dates were not recorded.

The eggs of the second batch hatched Sept. 7–8, and pupation took place from Oct. 5. Of the 18 resulting females, 4 were *infuscata* and 14 *lycia*. These emerged on the following dates :—

Dates of Emergence. 1911.	Female *infuscata*.	Female *lycia*.
Oct. 11......	2	2
„ 12......	1	4
„ 13......	....	1
From „ 11......	1	7
Totals	4	14

Family 5.

Parents G and H, both of the form *infuscata*, were captured *in cop.* in Oni Clearing by the lagoon, Sept. 15, 1911. The male G is a typical West African *infuscata*, although the subapical fore-wing bar is paler than usual, perhaps as a result of wear. In the female, however, the same marking is of a fulvous tint, as in *commixta* and *daira*. Eggs were laid Sept. 18 and hatched Sept. 26. The female parent died Sept. 20. No dates of emergence were kept, but the whole cycle fell well within the wet season, which lasted from about mid-March to Dec. 8, 1911.

The eggs produced 28 female offspring, all of the form *infuscata*—15 with the white subapical bar of the ordinary female *encedon*, 13 with the fulvous bar of the female parent. In two of this latter set, the hind wings are partially white, so that the specimens closely approach the form *commixta*.

It should furthermore be noted that some of the 13 specimens were much worn, but the scales still remaining left no doubt that the bar had been fulvous and not white.

Family 6.

Parent I. The female parent, of the *infuscata* form, was captured in Oni Clearing, April 27, 1912. Eggs were laid between April 30 and May 1, and the butterfly died May 2.

The eggs produced 42 female offspring, which emerged on the following dates. A single male *lycia* may have been accidentally introduced :—

Dates of Emergence. 1912.	Female *infuscata*.	Female *lycia*.
May 29	1	2
„ 30	1	1
„ 31	2	5
Unnoted..........	17	13 [1]
Totals	21	21

[1] In addition to the above, a single ♂ *lycia* was found in this category. It is excluded from the table because it seems probable that its appearance was due to accident.

Family 7.

Parent J. The female parent was captured in Oni Clearing, May 5, 1912. This female is much worn, but there is no doubt that it is of the form *commixta*. The pale fulvous fore-wing bar is evident in the specimen. Eggs were laid May 6, and the butterfly died May 8.

The eggs produced 12 female offspring, of which 3 were *commixta* and 9 *lycia*. The date of emergence, June 6, was only noted for a single *lycia*.

Family 8.

Parent K. The female parent, of the form *lycia*, was captured in Oni Clearing, May 7, 1912. Eggs were laid May 7, and the butterfly died May 8.

The eggs produced 28 female offspring, of which 7 were *infuscata* and 21 *lycia*. The dates of emergence were not noted.

Family 9.

Parent L. The female parent, of the form *lycia*, was captured in Oni Clearing on May 8, 1912. Eggs were laid May 9, and the butterfly died May 11.

The eggs produced on June 13, 2 female offspring, of which 1 was *infuscata* and 1 *lycia*. The latter is noticeably darker than its parent.

Family 10.

Parent M. The female parent, a rather dark *lycia*, was captured in Oni Clearing on June 1, 1912. Eggs were laid June 2, and the butterfly died June 4.

The eggs produced 12 female offspring of the form *lycia*, of which 5 emerged July 14 and 7 July 15.

The offspring are uniformly dark like the female parent.

Family 11.

Parent N. The female parent, of the form *infuscata*, was captured in Oni Clearing, June 1, 1912. Eggs were laid June 2, and the butterfly died Jnne 5.

The eggs produced 26 female offspring, of which 12 were *infuscata* and 14 *lycia*. Emergence took place on the following dates:—July 12, *infuscata* 11, *lycia* 12; July 17, *infuscata* 1, *lycia* 1; July 18, *lycia* 1.

Family 12.

Parent O. The female parent, of the form *lycia*, was captured in Oni Clearing on June 8, 1912. Eggs were laid on June 8–9, and the butterfly died June 10.

The eggs produced 41 female offspring, all of the form *lycia*, which emerged as follows:—July 13, eighteen; July 17, six; July 18, fourteen: July 19, three.

Family 13.

Parent P. The female parent, of the form *lycia*, was captured at the edge of the lagoon near Oni Clearing on April 19, 1912. The larvæ produced by the first batch of ova, laid April 21, were reared separately from those of the second batch, laid April 22. The parent died April 24.

The ova of the first batch hatched April 27, and produced 61 female offspring of both forms which emerged on the following dates :—

Dates of Emergence. 1912.	Female *infuscata*.	Female *lycia*.
May 24	2	2
„ 25	15	7
„ 26	3	9
„ 28	12	2
„ 29	2	7
Totals	34	27

The ova of the second batch hatched April 28, and produced 26 female offspring of both forms which emerged on the following dates :—

Dates of Emergence. 1912.	Female *infuscata*.	Female *lycia*.
May 22	0	2[1]
„ 25	1	3
„ 26	4	9
„ 27	2	0
„ 28	4	1
Totals	11	15

[1] These 2 *lycia* females became respectively the female parents S and Q, see p. 413.

Both *infuscata* and *lycia* were typical, but the latter varied in the extent of the black pigmentation of the fore wing.

Family 14.

Parents R, Q. The male parent R, of the form *lycia*, captured in Oni Clearing, May 24, 1912, paired May 24 with the female parent Q, of the

form *lycia*, one of the offspring emerging May 22 of the all-female family of parent P. (The male parent R subsequently paired with S.) Eggs were laid May 25 and 26 and the female parent died May 27.

The eggs produced 19 female offspring, all of the form *lycia*, which emerged on the following dates :—June 29, one ; June 30, sixteen ; July 1, two.

Two of the females which emerged on June 30 became respectively the female parents W and Y (see p. 414).

Family 15.

Parents R, S. The male parent R, of the form *lycia*, captured in Oni Clearing, May 24, 1912, paired May 26 with the female parent S, of the form *lycia*, one of the offspring emerging May 22 of the all-female family of parent P. (The male parent R had previously paired with Q.) Eggs were laid May 27–29, and the female parent died June 1.

The eggs produced 19 female offspring, all of the form *lycia*, which emerged on the following dates :—

Dates of Emergence 1912.	Female *lycia.*
July 1	3
,, 2	4
,, 4	6
,, 7	2
,, 9	4
Total	19

Family 16.

Parents T, U, both of the form *lycia*, were captured *in cop.* in Oni Clearing, May 24. Eggs were laid in 3 batches May 25–27, and the female parent U died May 29.

The eggs produced both males and females, all of the form *lycia*, which emerged on the following dates :—

Dates of Emergence 1912.	*lycia.*	
	Male.	Female.
June 28	1 [1]	0
„ 29	4 [2]	3 [3]
„ 30	4	1
July 1	2	1
„ 2	0	1
„ 3	0	1
„ 8	1	1
Totals	12	8

[1] This male became parent V, see below.
[2] Two of these males became respectively parents X and Z, see pp. 414, 415.
[3] One of these females became parent Z′, see p. 415.

The series exhibited much variation in the extent of the black pigmentation of the fore-wing and the hind-wing border.

Family 17.

Parents V, W. The male parent V, of the form *lycia*, was one of the offspring, emerging June 28, of the mixed family of parents T, U. The female parent W, of the form *lycia*, was one of the offspring, emerging June 30, of the all-female family of parents R, Q. Pairing took place on June 30. Eggs were laid June 30 and July 1, and the female parent died July 4.

The eggs produced 34 female offspring, all of the form *lycia*. The dates of emergence were not noted.

The family exhibits variation in pigmentation, but to a less extent than that of Family 16.

Family 18.

Parents X, Y. The male parent X, of the form *lycia*, was one of the offspring, emerging June 29, of the mixed family of parents T, U. The female parent Y, of the form *lycia*, was one of the offspring, emerging June 30, of the all-female family of parents R, Q. Pairing took place on

June 30. Eggs were laid in 4 small batches July 2–4, and the female parent died July 6.

The eggs produced 11 female offspring, all of the form *lycia*. The dates of emergence were not noted.

The variation in pigmentation is about the same as that of Family 17.

Family 19.

Parents Z, Z′. The male parent Z, of the form *lycia*, was one of the offspring, emerging June 29, of the mixed family of parents T, U. The female parent Z′, of the form *lycia*, was also one of the offspring, emerging June 29, of the same parents T, U. Pairing took place on June 30. Eggs were laid July 1–2, and the female parent died July 5.

The eggs produced both males and females, all of the form *lycia*, which emerged on the following dates :—

Dates of Emergence. 1912.	*lycia.*	
	Male.	Female.
Aug. 9	10	2
,, 10	2	2
,, 12	4	1
,, 13	4	7
,, 14	4	4
Totals	24	16

The variation in pigmentation is rather greater than in Families 17 and 18.

Family 20.

The parents of this and the next family were not found in Mr. Lamborn's material, and there is no note as to whether they were *infuscata* or *lycia*. A box of specimens appears to have gone astray, and it is probable that these two parents were included in it.

The family, all of which bore the same number ("834"), consists of females of *infuscata* and *lycia* in approximately equal numbers, which emerged on the following dates :—

Dates of Emergence. 1912.	Female *infuscata*.	Female *lycia*.
July 4	2	7
,, 5	5	11
,, 6	7	10
,, 8	4	0
,, 11	0	2
,, 12	17	6
Totals	35	36

Family 21.

Parent unknown. The family, all of which bore the same number ("846"), consists of males and females of *infuscata*, which emerged on the following dates :—

Dates of Emergence. 1912.	*infuscata*.	
	Male.	Female.
July 17	5	3
,, 18	9	0
,, 19	0	1
,, 20	2	1
Totals......	16	5

[Reprinted from the PROCEEDINGS OF THE ROYAL SOCIETY, B. Vol. 81]

On the Cross-breeding of Two Races of the Moth Acidalia virgularia.

By LOUIS B. PROUT, F.E.S., and A. BACOT, F.E.S.

(Communicated by Leonard Hill, F.R.S. Received January 8,—Read February 25, 1909.)

A. INTRODUCTION.

The general interest which has been aroused of recent years by the various researches which have been undertaken in investigation of the working of Mendel's Law of Heredity, and the adaptability of the Order Lepidoptera to such investigation, have led us not only to reconsider the results of some earlier and undirected experiments in moth-breeding, but also to seek out some peculiarly suitable species in order to take in hand a more exhaustive course of study along the lines most likely to yield further results in elucidation of Mendelism.

Résumé of some Previous Rearing Experiments.

Perhaps a brief reference should be made to our previously recorded attempts at pedigree-breeding.

Lasiocampa quercûs.—Crossings of the various local races were carried out extensively by A. Bacot and J. C. Warburg in 1896–1900, and the results of their work detailed in 'The Entomologist's Record,' vol. 13, pp. 114–116, 237–240, 256–259, 313–317, 338–342. The outstanding feature, as regards a possible bearing on Mendelism, is that two races from the same geographical region, when hybridised, produced progeny that segregated into the two parent forms, whereas when the southern French var. *meridionalis*, Tutt, was crossed with the Scottish var. *callunæ*, Palmer, no such segregation occurred, the larvæ being of an intermediate type.

Forres — Triphæna comes (*Agrotis comes*, Stgr. Cat.).—Some rather unsystematic breeding experiments with the interesting Forres forms of this species were made in 1902–1903 by ourselves and others, and are recorded in 'The Entomologist's Record,' vol. 15, pp. 217–221; vol. 16, pp. 1–5. The progeny from two wild melanic females segregated, that from ♀ A being divisible into 74 typical and 93 melanic, that from ♀ B into 39 typical and 22 melanic. From brood A offspring was obtained, namely, a batch from a single melanic pairing and a batch from melanic "stock"; the former gave 25 typical and 52 melanic, the latter 20 typical* and 48 melanic;

* "Nine" in 'Ent. Rec.,' vol. 16, p. 3, line 19, is a *laps. cal.* or misprint for "seven."—L. B. P.

the total, therefore, 45 typical and 100 melanic. Thus the segregation was Mendelian in its completeness, but less so in its proportions.

Cluny.—A little later, A. Bacot followed up this experiment with another on the same species, this time with material from Cluny, Aberdeenshire. The results are recorded and discussed in the 'Proceedings of the Entomological Society of London' for 1905, pp. lxvii–lxxi,* and more briefly in 'The Entomologist's Record,' vol. 17, pp. 340–341. In the generation F^1 60 per cent. of non-melanic against 40 per cent. of melanic were reared from melanic ♂ × non-melanic ♀. In F^2 100 per cent. non-melanic appeared from non-melanic parents, the melanic ♂ grandparents showing no influence; on the other hand, from extracted *melanic* pairings of like parentage, F^2 consisted of: in two broods, 30 per cent. non-melanic to 70 per cent. melanic; in another brood, 21 per cent. non-melanic to 79 per cent. melanic. In F^3, so far as tested, both forms bred true, *i.e.*, two pairings of non-melanic × non-melanic produced non-melanic offspring only (6 and 22 specimens respectively), and two pairings of melanic gave melanic only (24 and 12 specimens respectively). The strain was becoming weakly through inbreeding, and here died out. There is some suggestion here that non-melanic is recessive to melanic, though some of the proportions are rather inexact.

Xanthorhoë ferrugata (*Coremia unidentaria*).—A long series of experiments, extending from 1894 to 1898, was undertaken by L. B. Prout with a view to obtaining light on the curious colour-dimorphism of this species, and the results have been published in considerable detail in the 'Transactions of the City of London Entomological and Natural History Society' for 1897, pp. 26–34, and Tutt's 'British Lepidoptera,' vol. 5, pp. 61–64, and summarised in a later memoir, entitled "*Xanthorhoë ferrugata* and the Mendelian Hypothesis" ('Trans. Ent. Soc. Lond.,' 1906, pp. 525–531). These showed, as Mr. L. Doncaster pointed out in an interesting supplementary note ('Proc. Ent. Soc. Lond.,' 1907, pp. xx–xxii), *roughly* Mendelian proportions on the assumption that the black form was recessive to the purple. It seems to us curious, however, in spite of the large percentage of deaths which introduced a factor of indefiniteness, that one pairing of heterozygotes (No. 3 on p. 528 of the paper) should have yielded in F_1 11 specimens showing the recessive coloration as against only 6 showing the dominant—the "expectation" being 4 recessive against 13 dominant, or at best 5 against 12. At any rate, the species shows nearly complete segregation, and will be a valuable one for future Mendelian research.

C. dominula.—We may further mention that Mr. L. W. Newman, of Bexley, a careful and successful breeder of Lepidoptera, has recently observed

* On p. 13, line 8, "45 %" is a misprint for "40 %."—L. B. P.

apparent Mendelian dominance in the typical form of *Callimorpha dominula* over its yellow-hindwinged aberration *rossica*, and of *Abraxas grossulariata* over the aberration *varleyata*. He has very obligingly furnished us with statistics, so far as the experiments have yet gone; and as they are hitherto unpublished, we take this opportunity of putting them on record. Of *C. dominula*, a type ♂ × *rossica* ♀ paired in 1906 produced in 1907 a brood consisting entirely of typical specimens; a pair of these gave in 1908 the following result: 34 typical, 10 ab. *rossica*—there was a great mortality among the larvæ before and during hibernation, fully 60 per cent. dying. Of *Abraxas grossulariata*, a type ♂ × *varleyata* ♀ paired in 1907, produced in June–July, 1908, a brood consisting entirely of typical specimens; pairings from these gave, as a partial second brood, October–November, 1908, 24 of the type (including one aberrant but *not* varleyata) and 7 ab. *varleyata*—the rest of the larvæ now hibernating.

After some consultation we decided upon the small geometrid moth known as *Acidalia* (or *Ptychopoda*) *virgularia*, Hüb., as meeting the essential conditions. There are, be it observed, practical difficulties to be encountered with many species, which have been overlooked by theorisers on the nature of the work that *ought* to be done by Lepidopterists. Thus many moths are exceedingly difficult to pair in confinement; many are extremely averse to inbreeding, so that an inbred strain cannot be continued beyond two or three generations; many are difficult to bring through the winter, or require food-plants which are not always obtainable.

Convenience in Rearing.—Acidalia virgularia, on the other hand, will feed, apparently, on almost anything belonging to the vegetable kingdom, leaves of all sorts—whether fresh or withered—sliced carrot, etc., proving equally acceptable to it; it pairs very readily, is continuously-brooded throughout the summer, feeds up rapidly and generally without need of hibernation, and does not deteriorate through continuous inbreeding; moreover, its small size is a practical convenience both for the accommodation of large numbers of larvæ in a small space and for bringing large numbers of the set moths under the eye at the same time. Few, if any, other British species would offer all these advantages to the same degree; and as *Acidalia virgularia* produces in the south of France a race so different-looking from the British that more than one British field naturalist on seeing it has failed to recognise even the species, it is not difficult to trace the influence of the respective parent strains in crossings.

Origin of Stock.—Ova and pupæ of the southern French form were kindly supplied by Mr. H. Powell, F.E.S., from Hyères; wild moths of the London

form by Mr. J. E. Gardner, of Clapton, N.E. The former race is distinguished by its white or cream-coloured ground, almost devoid of grey dusting, and scarcely variable except in the intensity of the transverse black lines, which may be strong (the tendency in the particular strain with which we worked), or broken up into dots, or obsolescent; the latter is variable within limits, but always with the pale (not white) ground-colour profusely dusted with dark grey atoms, whether these be uniform throughout or more concentrated in certain areas. The Hyères form is therefore described in our experiments as "light" (L), the London form as "dark" (D). It is necessary to add that more or less intermediate phases of variation occur in some parts of Germany, Italy, etc., so that we have been dealing with *local races* rather than fixed recurrent "aberrations" or with incipient species.

The first cross-pairing was obtained on June 21, 1906, and filial generations I–X (F_1 to F_{10} on the well-known Bateson method) appeared from August, 1906, to November, 1908. Altogether, 5531 specimens have been analysed in preparing these notes, so that they may be regarded as fairly comprehensive as an indication of the behaviour of this particular cross-pairing.

B. Statistical Results.

General Remarks.—Altogether our breeding of *Acidalia virgularia* has been carried out to the tenth filial generation, and 5531 specimens have been subjected to careful analysis, exclusive of a few which have been more indefinitely summarised but which are confirmatory of the general results. We feel that we may, therefore, speak authoritatively on the general course of inheritance in the cross-breeding of these races, and that the imperfection of our statistical analysis is not due to ignorance of the forms with which we are dealing, but to the fact that their hybridisation really gives *no segregation capable of analysis by the human eye.* It is necessary to dwell somewhat on this point. At first sight it might appear a confession of incompetence to have to state—as we do quite frankly—that our figures are only approximations, and that in many cases a re-count (either by another entomologist or even by ourselves) might easily result in a slight modification of them; but when it is understood that there is, in the cross-breeds, every conceivable intergrade, it must be manifest that the distinction between "dark" and "intermediate" on the one hand, and "light" and "intermediate" on the other, becomes purely one of degree, and it is absolutely impossible to draw a perfectly consistent line throughout. Having made a special study of the family *Geometridæ* for nearly twenty years, one of us (L. B. P.) can at least claim to have acquired that eye for slight differences in them that will have

safeguarded him against any material error of judgment in the present investigations.

As regards the pure stock, or presumable homozygotes, inbreeding for ten generations, under more or less artificial conditions, has not had the very slightest influence on the pretty Hyères form nor, in the aggregate, on the London form. Excepting a single dark specimen, which was obviously an accidental importation (perhaps on food-plant, as the moth is so common in Mr. Bacot's neighbourhood), upwards of 400 specimens show not the slightest deviation from the clean whitish ground-colour which characterises the Hyères race. The dark form, which varies more in a wild state, naturally showed a greater range, and one or two broods, apparently by some accidental selective agency, became lighter than the normal; but here, again, we can confidently affirm that, among some 400 specimens, none have occurred which could possibly be mistaken for the "light."* It follows, therefore, that the bulk of those which we have classed as "intermediate" can be with certainty explained as blends originating from the hybridisation.

Crosses obtained.—Cross-pairings were obtained in each generation, usually in reciprocal crosses, and in not a few instances in duplicate. In many cases the progeny of the crosses was also carried on down to the generation collateral with that of F_{10} from the original cross. The complete scheme upon which we intended to work may be indicated as follows:—

Pure dark (D).—F_1 to F_{10}.
Pure light (L).—F_1 to F_{10}.
Dark by light (called cross-pairing *A*).—F_1 to F_{10}.
Light by dark (cross-pairing *a*).—F_1 to F_{10}.
Dark by light, ex F_1 (*B*).—F_2 to F_{10}.
Light by dark, ex F_1 (*b*).—F_2 to F_{10}.
Dark by light, ex F_2 (*C*).—F_3 to F_{10}.
Light by dark, ex F_2 (*c*).—F_3 to F_{10}.
Dark by light, ex F_3 (*E*).—F_4 to F_{10}.
Light by dark, ex F_3 (*e*).—F_4 to F_{10}.
Dark by light, ex F_4 (*F*).—F_5 to F_{10}.
Light by dark, ex F_4 (*f*).—F_5 to F_{10}.
Dark by light, ex F_5 (*G*).—F_6 to F_{10}.
Light by dark, ex F_5 (*g*).—F_6 to F_{10}.
Dark by light, ex F_6 (*H*).—F_7 to F_{10}.

* One curious strain is dealt with separately below, as its actual origin is altogether problematical.

Light by dark, ex F_6 (*h*).—F_7 to F_{10}.
Dark by light, ex F_7 (*I*).—F_8 to F_{10}.
Light by dark, ex F_7 (*i*).—F_8 to F_{10}.
Dark by light, ex F_8 (*J*).—F_9 to F_{10}.
Light by dark, ex F_8 (*j*).—F_9 to F_{10}.
Dark by light, ex F_9 (*K*).—F_{10}.
Light by dark, ex F_9 (*k*).—F_{10}.

Or in tabular form (see p. 139).

The actual hiatus in the carrying out of this scheme will be seen from the details which follow. The number of the dark × light crosses that faded out would suggest some inherent tendency to weakness in this rather than in the reciprocal cross; yet the oldest hybrid of all was a dark × light (*A*) and continued vigorous to the last. None of the hybrid strains was labelled "*D*," this letter being reserved for the pure dark strain.

In addition to these systematic crossings, a few quadroon broods and complex crossings of hybrids were obtained.

Most of the continuations of the broods were from single pairings, but occasionally—as when a number of specimens had emerged simultaneously and we could not be sure that they had not mated unobserved—we bred from stock. The question of the influence of individual parental characteristics as opposed to broader racial ones was not the least interesting in connection with our work.

It is to be remarked that the percentage of deaths in the early stages was generally quite insignificant, and that many of the broods reared to the imago state were so rich in individuals relatively to the fecundity of the species, that our statistics are incontrovertibly much more representative than those obtained from *Xanthorhoë ferrugata*, where the pupal deaths were often enormously numerous.

Since it is impossible to forecast what statistics may ultimately assume unexpected importance, the following record tends to err, perhaps, in the direction of over-completeness. Such deductions as we have been able to draw from the mass of figures will be reserved for the next section of this paper.

Brood *A*.—This was started in duplicate, one of the strains being lost at F_5. The reciprocal cross (*a*) was not obtained, as we had no dark ♀ of assured virginity.

(1) In the generation F_1 there were 62 specimens, all true intermediates with variation inconsiderable. In F_2, 66 specimens, variation considerable, 5 quite dark (perhaps less *brownish* than the pure Clapton race), others

Gen.	D.	L.	D × L. *A.*	L × D. *a.*	D × L. *B.*	L × D. *b.*	D × L. *C.*	L × D. *c.*	D × L. *E.*	L × D. *e.*	D × L. *F.*	L × D. *f.*	D × L. *G.*	L × D. *g.*	D × L. *H.*	L × D. *h.*	D × L. *I.*	L × D. *i.*	D × L. *J.*	L × D. *j.*	D × L. *K.*	L × D. *k.*
1	×	×	×	×																		
2	×	×	×	×	×	×																
3	×	×	×	×	×	×	×	×														
4	×	×	×	×	×	×	×	×	×	×												
5	×	×	×	×	×	×	×	×	×	×	×	×										
6	×	×	×	×	×	×	×	×	×	×	×	×	×	×								
7	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×						
8	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×				
9	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×		
10	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×

approaching this or mottled or banded with dark; none approaching the pure light form. In F_3, 21 specimens, variation slight, follow their actual parents *very closely*—*i.e.* all were intermediates. In F_4, 54 specimens, variation rather considerable in ♀'s, less in ♂'s; 2 ♀ dark, much as in F_2; several quite as light as F_1, none pure light. In F_5, 47 specimens, variation rather considerable, none very light, 7 (4♂, 3♀) dark.

(2) In generation F_1 all were true intermediates, though somewhat variable; a subordinate race-characteristic was perhaps adumbrated, which became more pronounced in a few specimens of each brood from A_2 to A_6, namely, a tendency to darkening in the *outer area* of the wings (a common characteristic of some species of *Acidalia*, such as *A. politata*, etc.). In F_2–F_6 the variability increased, but according to no fixed rule; in F_6 (20 specimens) the range was from almost pure light (very weakly marked) to almost pure dark, with intergrades. Two pairings were obtained in F_6, one of light × light, the other dark × light; the former yielded, as F_7, 47 specimens of remarkable constancy, most of which might be called pure light, three perhaps light-intermediate; the latter yielded, as F_7 (from fine dark ♂ × light ♀), some half-dozen specimens only. F_8, from the former of the two F_7 broods, consisted of 13 pure light and one (♂) intermediate; another F_8, from *stock* (of the latter of the two F_7 broods), also of 14 specimens, differed strikingly from its cousin brood in tone, all being intermediate, and somewhat variable. F_9 was again duplicated, one batch (labelled *A* ix ⊙), from light parents, consisted of 81, the majority light, but only about 30 per cent. pure light; the other batch (*A* ix ✻), also from light parents, gave 6 only, all pure light. F_{10} (ex. *A* ix ⊙), 21 specimens, ranged from light (1 or 2) to true intermediate (2 or 3), the majority light but *very slightly dusted.*

Brood *B.*—Carried only to the fifth generation (strictly speaking, the *fourth* generation; but, as shown in our "scheme," it has been thought better throughout to give uniform numbering to collateral lines, *i.e.*, to regard as F_2 the grandchildren of the original stock even though with strain *B* the crossing of the two races only commenced a generation later, with strain *C* two generations later, and so on). In generation F_2 there were 14 specimens, variation inconsiderable, all intermediate, lines rather weak. In F_3, 34 specimens, variation not great, similar to parent brood, but 3 or 4 distinctly light—beginning to "throw back" towards ♀ grandparent. For F_4 a duplicate pairing was obtained; one brood, 31 specimens, averaged distinctly paler than F_3, several closely approaching the pure light; the other brood, 52 specimens, also varied little, but more closely resembled the parent brood, only 3 or 4 (♀'s) being whitish the rest intermediate. In F_5, from the

former of the two F_4 broods, 32 specimens varied little, though not absolutely inappreciably, all light, yet not quite so pure as the original Hyères strain.

Brood *b*.—Obtained in duplicate, one strain carried on to generation F_5, the other to F_{10}.

(1) An interesting strain on account of an apparently hereditary predominance of the female sex, figures therefore given in full. In F_2 (28 ♂, 36 ♀) all were intermediates, though somewhat more variable than most first crosses. F_3 was duplicated; one brood (13 ♂, 17 ♀) showed considerable variation, ranging, in both sexes, from pure dark, through intermediates, to nearly, but not quite, pure light; the other brood (13 ♂, 24 ♀) also varied rather considerably: 3 almost pure dark, a few others approaching these, others intermediate or lightish, 7 with a characteristic facies, almost of the pale, well-lined Hyères form, yet less extreme and less white. F_4, from the former of the F_3 broods, consisted of 14 ♂, 25 ♀: both sexes quite variable, several ♂'s dark, 1 or 2 ♀'s light (not strongly lined), the ♀'s thus averaging somewhat the lighter. In F_5 (17 ♂, 27 ♀) the range of variation was much as in F_4. Adding the above numbers together, we find that this strain yielded only 85 ♂ against 129 ♀, a proportion of 2 : 3.

(2) This proved on the whole a very stable strain, though generations F_4 to F_6 varied more. F_2 was very uniform, intermediate. F_3 (7 only) similar, may have been a shade darker and a few showed a dark *border*, which became a feature of the strain. F_4 distinctly variable, though not quite reaching either extreme; a dark *central* shade, quite a feature of some, lacking in others. F_5 (19 only) very similar to F_4, but smaller, and perhaps hardly so variable. F_6 (66) strongly variable, particularly in the expression or suppression of the two rows of transverse dots, there being a sudden outcrop of specimens in which they are very pronounced—none such being observable in F_2 to F_5. Where these dots are on a white ground (14 specimens), "pure light" is produced; the rest are intermediate to dark, none very dark. F_7 consisted of 3 only, intermediate, weakly marked, but 2 with the borders darkened. F_8, 23 specimens, a singularly uniform brood, a phase of "intermediate" without strong dusting or lines of dots, the distal margin often darker. F_9 was duplicated, but both the broods (46 and 11 specimens respectively) closely followed F_8, though a few in the larger brood were a little more heavily dusted. F_{10} was almost a failure, only one (intermediate) specimen coming through.

Brood *C*.—Continued to generation F_9. In F_3 there were only 3 poor specimens, apparently intermediate, but no exact analysis possible. F_4, a large batch, moderately variable, range from almost pure light to darkish

but hardly dark; about half tend toward the light side. F_5 are similar to F_4, but perhaps less variable, very few pure light; might in the aggregate be termed light-intermediates. F_6, 36 specimens, are pretty variable, about 11 light (only with a stronger central shade than in the pure Hyères strain); 1 or 2 others nearly as light, weaker-marked; the rest intermediate to darkish, nothing extremely dark. The darkest pair available was used for parentage of F_8. F_8 (4 ♂, 16 ♀) are rather large, variable, the average dark, could perhaps be classified as 11 (3 ♂, 8 ♀) dark, 5 (♀) intermediate, 4 (1 ♂, 3 ♀) light, though not quite pure, but there are very gentle gradations; duplicate pairings out of F_7 (labelled *C* viii (2) and *C* viii (3)) vary somewhat less, *C* viii (2) (33 specimens) being intermediates, slightly variable in detail, and *C* viii (3) all being possible London forms (*i.e.*, dark), variable only in detail. F_9 was obtained only from the second of the above (*C* viii (2)); the specimens numbered 35, still intermediates, not unlike the parent brood.

Brood *c*.—Continued to generation F_{10}. F_3 consists of 7 only, intermediates, apparently not variable. F_4 varies from almost extreme light to almost extreme dark, but with intermediates which preclude any possibility of splitting up into darks and lights. F_5 (16 only) is similar, but the preponderating tendency is on the dark side, only one being really light with strong lines of dots. F_6, 29 specimens, is perhaps even more variable, 4 or 5 at least being pure dark, 6 or 7 at least pure light, others nearing both extremes (especially the light side) and a few intermediate. F_7 (from light ♂ × dark ♀) showed quite moderate variation, most being rather uniform, lightish intermediate, 2 or 3 (♂) darker, without being strikingly dark. F_8, 52 specimens, are very variable: about 12 pure dark, about 12 pure light (only with well-expressed central shade), the rest grading through. F_9 was bred in triplicate; brood *c* ix ⊙, 30 specimens, from intermediate parents, are very uniform, all being possible Clapton forms (dark), only 2 or 3 a little paler than would be normal for Clapton; *c* ix ✻, 7 specimens, from lightish parents with distinct dot-lines, follow the parents closely; the remaining brood (stock ?), 56 specimens, shows moderate variability, but mainly intermediate, the few darks and the few lights hardly quite pure. F_{10} was nearly a failure, but 5 specimens ex brood *c* ix ⊙ are all dark, 6 ex *c* ix ✻ all lightish, reproducing their parents' facies.

Brood *E*.—Only continued for two generations. The original pairing, ex generation F_3, was obtained in duplicate.

(1) In generation F_4 55 specimens were reared, all intermediate, the variation not considerable. In F_5, 83 specimens, the variation is considerably greater, ranging from darkish (not extreme) to specimens closely approaching the pure light strain, though slightly less pure, with central shade better indicated.

(2) In generation F_4 58 were reared, all intermediate and remarkably constant. Excepting the slight sexual dimorphism, the variation might be said to be practically *nil*. Progeny not obtained.

Brood *c*.—Continued to generation F_7. F_4 consisted of 77 specimens, all intermediate except, perhaps, one brownish ♀, which resembles some of the lightest London forms; the other 76 exceedingly constant. In F_5, 49 specimens, the variation is much greater, ranging from a few of each sex quite resembling the London forms to a few whitish, though certainly not pure. F_6, 78 specimens, extremely variable, though not definitely segregating; a few very dark, several darkish, one darkened in outer area, numerous intermediate, numerous light or lightish, the black dot-lines then generally (not always) well expressed, some with, some without, the dark central shade, 2 or 3 agreeing fully with the pure light strain. In F_7 only 6 moths were bred, from stock, variable from dark to light.

Brood *F*.—Continued to generation F_8. The original pairing was duplicated.

(1) F_5, 29 specimens, singularly enough, acted differently from *all* the other first crosses, being virtually a pure light brood, and we hoped that, for once, the light ♀ parent had acted as a dominant. Fortunately a large offspring was obtained (from stock) consisting of 150 specimens. These (F_6) are much more variable than F_5, but cannot be split up into light and dark definitely; roughly classified, we made 45 light (perhaps a dozen *pure* light), 95 intermediate, 10 dark (none extremely), but the gradations are so extremely slight that a re-count would be almost sure to modify the figures somewhat. Two pairings were obtained: one brood of F_7 (ex light ♂ × dark ♀) yielded 7 specimens, all more or less intermediate, 3 more dusted than the other 4; the other brood (ex light ⚥, with strong dot-lines), 6 specimens, all rather light, but only one with the lines sharp. F_8, from a pair of the lightest specimens in the former of the last-mentioned broods, again proved numerically inadequate, only 7 coming through; these are rather variable, 6 being on the lighter side (2 or 3 pure, the others grading towards intermediate), the seventh strongly dusted (dark intermediate). Attempts to continue the strain proved unsuccessful.

(2) F_5 here consisted of 47 specimens, the variation not considerable, the general facies being very uniform, but the colour ranging from lightish (not pure) to a lightish intermediate. Offspring was not obtained.

Brood *f*.—Continued to generation F_{10}, though then on the verge of extinction. F_5, not variable, would certainly be classed as true intermediate, though rather on the light side. F_6, 64 specimens, is much more variable, two or three being pure light, several others closely approaching it, many

intermediate, and a few rather dark. F_7 (ex light ♂ × dark ♀) consists of 32 specimens, extremely uniform, all intermediates, with fairly distinct dot-lines. F_8, 44 specimens, again vary, yet with no absolutely pure white, and only 3 or 4 very *strongly* dark-dusted, nothing extraordinarily dark. Duplicate pairings were here obtained; from a rather dark ♂ × rather light ♀, sprang, as F_9 (labelled *f* ix ⊙), 28 specimens having a similar range to F_8; from an apparently intermediate pair, the ♀ darkened in outer margin, 33 specimens, rather constant, intermediate, nearly all well dusted on a whitish ground. F_{10}, 2 specimens only, agree with the F_9 brood last mentioned, from which they sprang.

Brood *G*.—This cross was obtained, but not propagated beyond the single generation (F_6). The brood consisted of 69 specimens, slightly more variable than most first crosses, yet in no way startling. Most are quite normal intermediates, 2 or 3 might better be classed as dark, yet not extreme,

Brood *g*.—Continued to generation F_{10}. In F_6, 35 specimens, the variation is inconsiderable, all being intermediate, though such variation as there is is towards the "light" side. F_7 was obtained from a lightish pair, and yielded 4 lightish specimens. F_8, 47 specimens, was again rather constant, a light-intermediate. F_9 was obtained in duplicate; one batch (labelled *g* ix ⊙, parents rather weakly marked) consisting of 18 specimens, intermediate, nearly all weakly marked, the colour ranging from darkish to lightish without extremes; the other batch (*g* ix ✻, from a better-marked pair) considerably variable, 49 specimens, mainly well-lined, about 12 almost the pure Hyères form, 3 or 4 approaching the London form, many intermediate. F_{10}, 47 specimens from the last-named brood, follows it well on the whole, nearly all being well-lined, though there is much variation in tone and many (especially of the darker ones) are rather strongly darkened towards the outer margin.

Brood *H*.—Continued to the second generation of the cross, that is, to F_8. F_7, 56 specimens, is very constant, and very typical of the normal "first cross"—all intermediate. F_8, 49 specimens, is very variable; hardly any are quite pure light, only 1 or 2 pure dark (and not very intense); but there is almost every other variation, in size, strength of markings, general facies, and ground-colour.

Brood *h*.—Continued to generation F_{10}. In F_7, 12 specimens, the variation is very slight, all being lightish intermediate. F_8, 36 specimens, is decidedly variable, the range being from pure light to darkish intermediate, with the usual intergrading. F_9 was duplicated; one batch (from light, well-lined parents) yielded 17 specimens, variable from pure light (though not intensely white) to intermediate, 11 or 12 having the lines rather strong; the other

batch yielded 16 specimens, hardly variable, intermediate to light-intermediate, weakly lined for the most part. From the former of these batches sprang, as F_{10}, a brood of 17 specimens, rather constant, with a uniform facies which struck one as recognisable even when they were emerging; all are intermediate in colour, the dusting weak, the lines rather strong.

Brood *I.*—Obtained but not carried on. The single family (F_8) consists of 46 specimens, intermediate, decidedly constant.

Brood *i.*—Continued to generation F_{10}. F_8 consists of 22 specimens, rather constant, normal intermediates. F_9 was obtained in duplicate; from one pair (labelled *i* ⊙) resulted a very variable brood of 32 specimens: 5 or 6 pure light, others near, 7 or 8 pure dark (some quite extreme), others near, and various intergrades; from the other pair (labelled *i* ◇) another variable brood, of 12 specimens only, mostly lightish-intermediate, 1 almost pure light, though slightly brown tinged, 1 pure dark, 2 darkish. F_{10} was reared from both these broods; that from the former consisted of 44 specimens, intermediate to dark, presumably from some of the darker examples among the parent stock; the latter of 25 specimens, varying in colour from white to intermediate, yet with a most conspicuously definite facies, all being well lined, with the central shade strong and clear cut in addition.

Brood *J.*—F_9, 29 specimens, intermediate to lightish-intermediate, fairly constant. F_{10}, 5 only, certainly variable, though without extremes—altogether too few for generalisations. The reciprocal cross (*j*) was not secured.

Brood *K.*—Obtained in duplicate. Both batches (56 and 38 specimens respectively) normal intermediates, the variation slight. Some undersized specimens look a little pale, but this is because of their weak scaling.

Brood *k.*—40 specimens, variation moderate, from light-intermediate to dark-intermediate.

The quadroons and other irregular crosses have next to be briefly dealt with. In the first filial generation pure light ♂ was crossed with hybrid ♀ (out of the brood described as *A*, number (2) in this paper), and the strain carried on for four generations (F_2 to F_6). It continued "intermediate," with the variation appreciable but not considerable, only in F_6 there were more of the whiter specimens. In generation F_6 this quadroon race was crossed with the hybrid race called *f* in this paper; the variation in the offspring (F_7) was only very moderate, ranging from light to lightish-intermediate.

Also in generation F_6, crosses of $b \times c$, $b \times f$, and $G \times C$ were obtained, but only $b \times f$ was followed up to subsequent generations. All these three were

interesting, as in each case both the parents were more or less extreme, the ♂'s light and the ♀'s dark; the offspring of $b \times c$ (16 specimens) varied little, all being intermediate or lightish; that of $G \times C$ (4 specimens only) much more, the single ♂ bred being darkish, the 3 ♀'s light, weakly marked. In this generation (F_7) the specimens of $b \times f$ (34 in number) varied little, the range being from lightish-intermediate to lightish, almost reaching the pure Hyères form; the characteristic dark border of the parent strain b (2) entirely disappeared. In F_8, 47 specimens, the variation was considerably greater, ranging from pure light (about 8) to pure dark (2 or 3), the majority intermediate, and the extremes not very intense. F_9 was obtained in triplicate; from a light pair (especially the ♀) sprang a brood of 34 (labelled $bf\,\boxed{\diamond}$ ix), hardly variable, all light or lightish; from a somewhat intermediate pair a brood of 44 (labelled $bf \odot$ ix), variable, from lightish (not extreme) to dark—about 8 that might be likened to average London specimens; from stock a batch of 23 (labelled $bf \otimes$ ix), slightly variable, all light or lightish except 1, which is intermediate, brown. In generation F_{10} one brood was raised, simply labelled bf x, the note of its *exact* parentage having unfortunately been mislaid; it consists of 32 specimens, nearly pure light and not varying much, a few virtually of the Hyères form, but the larger number with a fairly distinct central shade.

In generation F_8 a pairing was obtained between a ♂ out of brood H (intermediate or darkish, weakly-marked) and a ♀ out of brood c (intermediate or rather light, the central shade distinct). In generation F_9 a brood of 33 appeared, rather variable, from light-intermediate to dark (not intense), mostly weakly lined, a few strongly freckled. Their progeny (F_{10}, 19 specimens) are also variable, from light (3) to dark (5); 4 are intermediate, fairly well scaled, the rest more or less poorly scaled, weakly-marked.

It remains to notice a strain which must be treated as of uncertain ancestry, and which originated in F_6 and has been carried on to F_{10}. It was believed to have sprung from pure dark ancestry, a number of hibernating larvæ of F_3 in that strain having fed so slowly as to be still in the larval state when their nephew-brood of larvæ (*i.e.* pure dark F_4) arrived, and having been mingled therewith; but in F_6 the behaviour of the strain was so unprecedented that we feel forced to imagine there must have been some accidental importation of hybrid or light material, inexplicable though it is, considering the care that was taken. Of course, it is open to those who so desire to assume that there was here a true mutation, but as the white form has never been known in Britain, and inbreeding has not changed the rest of our pure dark stock, we ourselves cannot regard such a view as even worthy to be provisionally entertained, unless confirmation be forthcoming.

Brood *D* ✻.—This aberrant stock in F_6, which we called *D* ✻ vi, consisted of 41 specimens, 18 of them pure light, 2 nearly pure but browner in ground-colour, a few normal intermediates, and about 12 typical dark. By analogy with the rest of our material this would suggest being a second generation from a hybrid. On account of the riddle of its origin, 5 pairings from this brood were obtained, 2 others attempted proving infertile.

(1) From a light pair sprang, in F_7, a brood of 16 (labelled *D* ✻ vii (2)) all light, about half being quite extreme, the rest slightly more dusted.

(2) From another light pair, F_7 consisted of 47 (labelled *D* ✻ vii (3)), rather variable from pure Hyères form (4 or 5) to intermediates. Their progeny in F_8 (64 in all, from different pairings) varied conspicuously, the *majority* light to intermediate, perhaps only one really *dark*, and that not very extreme. In F_9 (two broods, 67 specimens) the variation was less, only ranging from light to intermediate; all the four actual parents were more or less light. In F_{10} (three broods, 96 specimens) the variation again increased somewhat, but with the lighter forms still in the ascendant and thoroughly dark ones only occurring, and sparingly, in *one* of the three broods—labelled *D* x (1) ⊙, and noteworthy for its darker average tone than its parent brood.

(3) From yet another light pair, F_7 (26 specimens, labelled *D* ✻ vii (4)) bred absolutely true to the extreme parent form (= wild Hyères type). One pairing produced, in F_8, a further brood of 24, all equally pure, unfortunately lost here. Another pairing produced, in F_8, a very *variable* brood of 45—15 pure light, about 15 others lightish to light-intermediate, the rest darker, 1 or 2 practically "dark." From a pairing of rather light, well-marked specimens in the latter of these (the variable) was obtained, in F_9, a brood of 38 varying much less than the parental one, indeed pretty constant light-intermediate, rather well-lined. Their offspring (F_{10}, 42 specimens) would nearly all be classed as "light-intermediate" in some sense, yet wonderfully variable within this limit; whitish weak-marked, similar examples but greyer behind the outer line, moderately light strong-marked, intermediate (2 or 3 strongly-marked, 2 or 3 weaker-marked) are all represented.

(4) From a dark pair, only three specimens were reared in F_7 (labelled *D* ✻ vii (6)). These were darkish intermediate. Fortunately a ♂ and a ♀ emerged together and copulated. The resultant F_8 (49 specimens) varied a good deal, one only being pure light, the rest about half intermediate (a few light-intermediate) and half darkish to dark, but with intergradations. F_9 (78 specimens, 3 broods) was moderately variable, but all should be classed as broadly "intermediates." F_{10} (49 specimens) was variable, ranging from intermediate to *dark*, the average darker than in F_9; perhaps about

20 would be called dark, but there is no clear line of demarcation. The return to a darker type might be called atavistic, but more probably the actual parents—which are not known—happened to be among the darkest ones of F_9.

(5) From a dark ♂ × light ♀, F_7 consisted of 21 specimens (labelled *D* ✻ vii (7)), all normal intermediates, with no appreciable variation. The strain was unfortunately lost.

C. General Conclusions.

From the foregoing mass of detail a few facts emerge with conspicuous clearness, and certain other points are sufficiently suggested to be worth putting forward, at least tentatively.

In the first place, there is most certainly no Mendelian dominance in coloration in the cross of the dark (London) race of *Acidalia virgularia* with the light (Hyères) race. With remarkable persistence, a first cross of the pure races produced a form *intermediate in coloration.* The sole exception, out of two dozen such crossings, is the brood noticed above as *F*, No. (1).

But, in the second place, it is perfectly well known that colour-dominance is not the essential feature of Mendelism. As Mr. Bateson says,* "The essential fact which Mendel discovered is the segregation of characters in gametogenesis." Now, as the intermediate form, which was so nearly universal in the first crosses, did not appear in either of the "pure" strains, it may well be taken as the normal manifestation of hybridity in this blend, corresponding to the "blue" Andalusian fowl and other well-known cases; and it is certainly noteworthy that a rough resolution into a wider range of forms proved quite general in the F_2 generation. That proportions did not agree with expectation might be due to defective analysis. For example, the said "hybrid" or "intermediate" might have a wider range of variation than had been discovered by the investigators, who might thus have referred some hybrids to one of the "pure" forms. But a glance at our actual results convinces us that it is not generally too *few* intermediates that we obtained in F_2 but too *many*; and fortunately we know very accurately the limits of the variation of at least one of the pure races (L), so that there seems no chance, on the assumption of gametic purity, of our having classified pure "lights" as "intermediate." It is, however, further noteworthy that some, at least, of the extracted strains (light × light, ex hybrid, viz., *A* (2) in generation F_7,† ? *B* in generation F_5 (1), $b \times f$ ◇ in generations F_9 and ? F_{10},

* 'Progressus Rei Botanicæ,' 1906, p. 368.

† But if this was really "pure" whence came the single "intermediate" ♂ in its offspring?

? D ✻ (1) in generation F_7, ? D ✻ (3) in generations F_7 and one section of F_8;* dark × dark, ex hybrid, viz., C (3) in generation F_8, c ⊙ in generations F_9 and F_{10}) attained a considerable standard of purity; and also that a few of the extremest (light × dark) pairings among hybrids (such as $b \times c$, $b \times f$, D ✻ (5), and ? A (2) in generation F_7) were the most reliable in producing again genuine intermediates. ($G \times C$ was possibly an exception, but the parents here were not so extreme in colour as to render hybridity unthinkable.)

Another fact that can be stated with certainty is that our experiments have revealed no other decisive "reversion to type" than the kind which Mendelism would demand; the intermediates have been quite as stable as Mendelism would expect in hybrid pairings. Whatever be the explanation, it would appear that the hybrid form cannot be "bred out"; except in cases where a selective mating has been employed and the rest of the brood allowed to die out, intermediates have continued to appear through all the generations.

Without desiring to dogmatise, we feel it is necessary to remark that neither of the points last considered—the obtaining of a comparatively uniform type by selective mating and the persistence of intermediates under other circumstances—belongs exclusively to any one theory of heredity, while such occurrences as those noticed in the footnotes on broods A_2 and D ✻ (3) are harder to reconcile with Mendelism than with, for example, the Galtonian view. On the whole, the apparently large responsibility of direct parenthood suggests to us the idea of some such principle as is involved in the well-known formula of one-half the characters from the parents, one-fourth from the grandparents, etc.

Over and over again some trifling race-characteristic has interested us in a particular strain, including—besides the tendency for some broods to favour the slightly darker variations and others the lighter—obvious differences in the expression or suppression of the transverse "dot-lines," tendency to develop a dark central shade or a dark marginal area (for instance, brood b (2)), and so forth. Any of these would have been well worthy of minute study, either from a Mendelian or a non-Mendelian point of view, had time and opportunity allowed. We suspect, however, that in large measure they also would be found traceable to direct parentage, for it is certain that in some cases cousin-broods differ quite materially in some of these characteristics, and that a reference to their parents shows how closely these are followed; see, for instance, some of the references under the statistics of broods c, g, h, etc. The sex-predominance in brood b (1) was another peculiarity which deserved more attention than it received.

* But how would Mendelism account for the (very variable) *other* section of F_8

We noticed also that the larvæ were very variable, and it is not impossible that an analysis of their variation might yield some results of value.

As a final impression, we would suggest that our failure to find Mendelian inheritance at work was due mainly to our bringing together two comparatively remote geographical races (as with Messrs. Warburg and Bacot's *Lasiocampa meridionalis* × *callunæ*) and that we, personally, now only expect to find segregation in the case of crosses of two forms occurring together (like the two forms of *Triphæna comes* or those of *Xanthorhoë ferrugata*), where a long course of natural selection has presumably eliminated the intermediates. We pointed out in the introduction that just such intermediates of *Acidalia virgularia* as were produced artificially by crossing our specimens from London and Hyères (localities where they are apparently quite unknown in a wild state) do occur in a state of nature in other parts of its geographical range.

A few pairings which occurred in generation F_{10} produced ova which have been handed to Mr. W. Bateson in the hope that he may be able to follow up our researches in the species. Unfortunately both the pure strains have been lost, but possibly Mr. Bateson will be able to extract them, by selective pairing, from the new hybrids, which we labelled *M* xi and *m* xi.

Harrison and Sons, Printers in Ordinary to His Majesty, St. Martin's Lane.

[*Reprinted from the* PROCEEDINGS OF THE ROYAL SOCIETY, B. Vol. 85]

Further Experiments on the Cross-breeding of Two Races of the Moth Acidalia virgularia.

By W. B. ALEXANDER, B.A., late Vintner Exhibitioner of King's College, Cambridge.

(Communicated by Prof. E. B. Poulton, F.R.S. Received January 3,—Read February 22, 1912.)

A communication on the heredity of the two forms of this species was read to the Royal Society on February 25, 1909. In that paper Messrs. Prout and Bacot gave an account of a large number of broods of this moth reared by them for nine generations.

At the end of the paper they mentioned that they had handed to Mr. W. Bateson ova produced by pairings in generation F_{10}. It was the larvæ derived from these ova which Mr. Bateson gave into my charge in February, 1909.

Of the five broods which I thus obtained I only managed to continue two, as the individuals of the others emerged at such long intervals that I never had a male and female alive at the same time. Fortunately, however, the two I reared were the most interesting.

Brood 2.—This brood had been labelled DI✻, gen. xi, by Mr. Bacot. Eleven moths emerged (4 ♂, 7 ♀) and from them I obtained two lots of ova —Broods 6 and 7. From Brood 6 I reared 35 moths (16 ♂, 19 ♀) and obtained three more lots of ova—Broods 9, 11, and 12. Brood 11 was liberated in the larval stage; from Brood 9 I reared 64 moths and from Brood 12, 38 moths (23 ♂, 15 ♀). From Brood 7 I reared 30 moths (14 ♂, 16 ♀) and obtained one lot of ova—Brood 13; from which I reared 92 moths (45 ♂, 47 ♀).

Thus of this strain I reared no less than 270 individuals, distributed in six families and three generations, and the striking feature was that they showed no appreciable variation. They were all of a yellowish colour with a slight amount of dark speckling on the wings.

I had not at this time seen any specimens of the original light form of the species, var. *canteneraria*, from Hyères, but when, through the kindness of Prof. Poulton, I was enabled to examine Messrs. Prout and Bacot's specimens in the Hope Collection at Oxford, I saw at once that all the descendants of my Brood 2 should certainly be classed as *canteneraria*. They did not show any more speckling of black than typical forms of that variety, but their yellow ground-colour was much darker than that of typical *canteneraria*,

though certain males, even reared from Hyères eggs direct, were as yellow as my moths.

The history of this race appears to be as follows:—Some light forms appeared among the dark ones in generation 6 in a box which was supposed to contain the pure dark strain. A number of the descendants of this brood were reared and in general gave a mixture of pure light forms and forms intermediate between light and dark. In some cases where two of these light individuals were mated they yielded nothing but lights, in others a mixture of lights and intermediates. On the other hand the darkest forms continued to throw light individuals when mated together. The actual parents of my Brood 2 appear not to be known, but there is no doubt that they were members of the generation 4 in descent from the original aberrant individuals. We thus see that it took five generations to establish a pure light brood from the original light individuals whose origin was quite inexplicable.

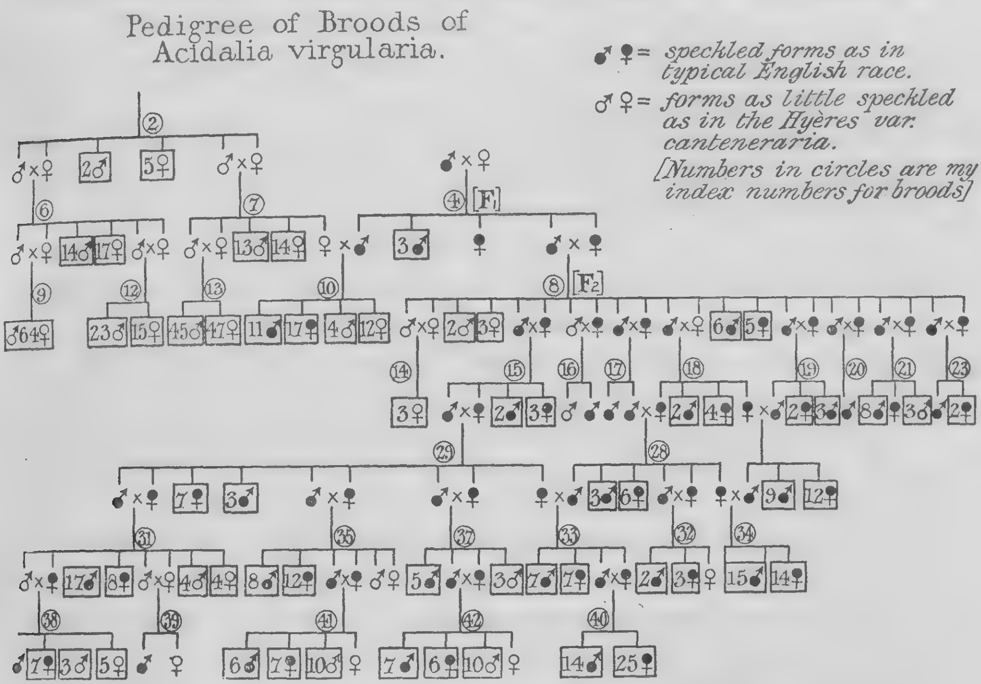
Brood 4.—This was the brood labelled DxLMxi by Mr. Bacot. They were the result of mating a pure dark male with a pure light female, both of whose ancestors had been reared in captivity for 11 generations. It was thus what is ordinarily known as an F_1 brood, though readers of Messrs. Prout and Bacot's paper will note that, though they claim to have numbered their broods according to "the well-known Bateson method," they have not confined F_1, F_2, etc., to the first, second, etc., generations of a hybrid strain, but have given these numbers also to broods of the pure strain, dating arbitrarily from the broods which were first reared in confinement.

My F_1 brood consisted of seven moths (5 ♂, 2 ♀), all of them distinctly speckled with black to a greater extent than in the light form, whilst their ground colour was a dirty white, not nearly so yellow as in my Brood 2.

From this brood I obtained one lot of ova—Brood 8, both of whose parents were of the type just described, and another lot of ova from a male of this brood mated with a female of Brood 7 (one of the pure yellow *cantenraria* broods descended from Brood 4). This I labelled Brood 10.

Brood 10.—This brood, consisting of 44 moths, possessed the yellow ground colour of its mother throughout, but 28 of the moths were distinctly speckled like their father, whilst 16 were exactly like their mother. This points to the ratio of 2 speckled : 1 unspeckled, but I think the numbers in this brood must be distrusted, since for some reason there were also 29 females and 15 males, which again suggests a ratio of 2 to 1, though of the total number of moths I have examined 305 were males and 309 females.

Brood 8.—This was the F_2 brood of 34 individuals, and exhibited a very considerable amount of variation, much more than that in F_1. I found, however, that it was quite easy to distinguish 9 moths as having no more speckling than pure *canteneraria,* whilst the remaining 25 were distinctly more speckled. Of the nine unspeckled (4 ♂, 5 ♀), three males were as yellow as the individuals of Brood 4, one distinctly paler, the females were all paler, two of them as white as the lightest of the pure Hyères race. It thus appeared that about one quarter (9 out of 34) of the F_2 brood were referable to the pure light race, though several of the males were yellower than any but extreme examples of it. The numbers suggested at once that the



unspeckled Hyères race was recessive to the speckled English form. I reared a number of further broods from pairs of the F_2 moths, and with one exception (Brood 39) this supposition would account for the composition of all the succeeding broods (see Pedigree).

I do not think it is necessary to deal with the subsequent broods in so much detail, as their mutual relationships will be visible from the pedigree.

The last generation emerged at irregular intervals in the early months of 1911, and only 3 females laid eggs. From one set of ova a few larvæ emerged, but only lived for a few days. Thus the race became extinct, perhaps owing to complete inbreeding for six generations.

The descendants of Brood 8 may be classified as follows :—

Both Parents Unspeckled (Broods 14 and 39).—Offspring, 4 unspeckled, 1 speckled. The one speckled moth resulting from this type of mating in Brood 39 is the only serious difficulty in the way of accepting a normal Mendelian relationship between speckled and unspeckled types. If it stood entirely alone I should have to regard it as due to some sort of error, though I did my utmost to guard against mistakes. But in the history of Messrs. Prout and Bacot's aberrant strain already mentioned, and in some of their other broods, there are definite cases of speckled forms originating from two non-speckled parents. Possibly one of the parents in these cases is a heterozygote indistinguishable in appearance from a recessive.

Both Parents Speckled.—In some broods (15, 17, 19, 20, 23, 29, 28, 30, 33, 34, and 40) all the offspring are speckled; in others (8, 21, 31, 35, 37, 32, 41, and 42) some of the offspring are non-speckled.

These eight broods consist of 161 moths, of which in theory $\frac{1}{4}$, or 40, should be non-speckled, and 121 speckled. Actually we find that 51 were non-speckled and 110 speckled.

One Parent Speckled and One Parent Non-Speckled.—In one brood (18) all the offspring were speckled; in the remainder (10, 16, and 38) some of the offspring are non-speckled. These three broods consist of 62 individuals, of which theoretically 31 should be speckled and 31 unspeckled. Actually we find that 37 were speckled and 25 non-speckled.

These numbers are sufficiently near those demanded by theory to give considerable support to the theory that the factor which causes the wings of the English form to be much speckled with black is dominant to its absence in var. *canteneraria*. A study of the much larger numbers reared by Messrs. Prout and Bacot, now in the Oxford Museum, reveals the fact that though this is evidently an approximation to the truth, it is not universally true. For in several of their F_1 generations a few non-speckled moths occur, the numbers being as follows:—

A	58	speckled,	2	non-speckled
C	3	,,	0	,,
c	7	,,	0	,,
h	12	,,	0	,,
H	56	,,	0	,,
G	68	,,	1	,,
*g**	20	,,	3	,,
7 F_1 broods,	224	,,	6	,,

* Several much rubbed not included.

These figures again suggest that heterozygotes may occasionally be indistinguishable from recessives. This, as already mentioned, would account for all the anomalies met with so far.

I have studied also the F_2 families at Oxford, grouping them also into speckled and non-speckled. I find that they are :—

A	65	speckled,	0	non-speckled.	
E	32	"	12	"	
e	38	"	10	"	
C	42	"	12	"	+ several much rubbed.
c	27	"	3	"	+ a few "
h	22	"	12	"	+ " "
H	33	"	11	"	+ " "
F	94	"	56	"	a few doubtful.
g	2	"	2	"	
G	4	"	0	"	doubtful, a good deal rubbed.
10 F_2 broods,	359	"	118	"	

These numbers appear very good, as theoretically we should expect 358 : 119, but it will be noticed that Broods A and F compensate for one another. Brood A is definitely exceptional; Brood F is a composite one derived from a number of females; this should, of course, make no difference to the numbers, but if separated it might have been found that one female produced only light offspring as A produced only dark ones.

Taking away A and F we have 200 speckled to 62 non-speckled, where expectation would be 197 speckled to 65 non-speckled—a very close agreement.

It would thus appear that speckling is an ordinary Mendelian dominant to the absence of speckling, but that whilst in most cases the heterozygous individuals resemble the dominant they may occasionally be indistinguishable from the recessive. Perhaps it would be more accurate to say that speckling is usually dominant to non-speckling, but that occasionally non-speckling is dominant to speckling.

The speckled individuals vary from moths whose wings are only slightly more speckled than in var. *canteneraria* to moths whose other markings are almost obscured by black scales. I believe that this variation is met with among the specimens taken wild in England, but the dark ancestors of my moths were of the most thickly speckled type found in the neighbourhood of London. This type occurred at intervals among the descendants of my Brood 4, and I think it is probably the homozygous speckled type, especially

as Broods 33 and 40, consisting of 16 and 39 individuals respectively, maintained this type with practically no variation for two generations. It is impossible, however, to draw a line between this type and less speckled forms, as in some broods there is a perfect gradation down to the (so-called) non-speckled type.

The original London moths differed from any of my rearing in being suffused with a brown colour, which was, however, approached by some three of the most speckled individuals in my Brood 8, which were all males. Among the Oxford specimens there are some of this brown colour without speckling, so that it is evidently due to a factor independent of the speckling. I cannot account for the lack of inheritance of this colour nor for the various yellow and whitish ground-colours among my own moths. As already mentioned, the descendants of Brood 2 all had a uniform yellow ground-colour. Amongst the unspeckled descendants of Brood 4 the males were mostly of this same yellow colour and the females invariably lighter; the same is true of the pure *canteneraria* from Hyères, in which, however, only occasionally are the males yellow like my Brood 2, the majority being much paler. I have found it impossible to classify the speckled moths according to ground-colour, as, when they are much speckled, this is difficult to estimate. In general, however, the females are lighter than the males.

There is another respect in which these moths vary to a considerable extent, and that is in size. The following table shows the numbers of moths among the descendants of Brood 4, of various breadths across the wings:—

Numbers of	Millimetres. 13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Males…………	—	1	6	29	57	66	36	8	—	—	—
Females………	—	—	—	5	11	24	49	66	35	12	—
Totals ……	—	1	6	34	68	90	85	74	35	12	—

It will be seen that these figures form a normal curve, which is due to the combination of two curves, one of males with an average of about 17·5 mm., and one of females with an average of about 19·5 mm.

Now, some of the individual broods depart markedly from these averages, *e.g.* :—

Numbers of individuals of		Millimetres. 13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	Average. mm.
Brood 40	♂ …	—	—	—	—	1	4	7	2	—	—	—	18·4
	♀ …	—	—	—	—	—	—	1	7	12	4	—	20·7
Brood 34	♂ …	—	1	3	7	4	—	—	—	—	—	—	15·9
	♀ …	—	—	—	2	8	2	1	—	—	—	—	17·2

It would be natural to suppose that such a great difference in size between two broods would be due to heredity or to some great difference in the conditions in the larval stage, but I can find nothing of the sort to account for it.

The parents of Brood 40 measured ♂ 18·0, ♀ 20·3, whilst those of Brood 34 measured ♂ 17·9, ♀ 19·6.

The parents of 40 were both members of 33, which averaged ♂'s 17·7, ♀'s 19·7; the ♂ parent of 34 belonged to 30, which averaged ♂'s 17·0, ♀'s 18·7, whilst the ♀ parent of 34 belonged to 28, which averaged ♂'s 17·5, ♀'s 18·2. It is true that the ancestors of Brood 34 were distinctly smaller than those of Brood 40, but they did not differ from the normal nearly so widely as does Brood 34 itself; and, taking into account all broods containing over 10 moths, I find that the average spread of the brood shows no correlation with that of its parent nor with those of the broods of which the parents were members. I conclude, therefore, that breadth of wing is not hereditary.

It is, of course, impossible to prove that these variations in size are not due to differences of conditions, though most of the conditions have been kept very uniform. The moths were reared throughout in similar boxes and the larvæ never fed on anything but dandelions. The main difference of conditions between the broods was due to the different temperatures of different periods of the year. This has a marked effect on the length of time required for development. Eggs laid from April to August only take about two months to reach the imago stage, whilst eggs laid from September to November take about four months if the larvæ continue feeding, or from seven to eight months if they definitely hibernate and cease feeding.

In spite of these great differences, moths of the broods which have hibernated are, on the average, exactly the same size as those which have completed their development in two months.

If the differences were due to different temperatures at the moment when the moths emerged, those broods which emerged from July to October must have experienced warmer conditions for emergence than those which emerged from December to June, yet on the average there is no difference between the two groups. I am therefore entirely at a loss to explain the considerable variations in size which occur.

Summary.

It will be seen that I agree with Messrs. Prout and Bacot's conclusion that *Acidalia virgularia* and its variety *canteneraria* are not two Mendelian forms of the species, though I believe I have shown that one of the

differences between the two forms, namely, the speckling of *virgularia*, behaves in most cases as a Mendelian dominant to the absence of this speckling in *canteneraria*. Even to this rule I am bound to admit there are certain exceptions. To account for this I have to assume that, whilst the heterozygote is usually more or less like *virgularia*, it may sometimes be indistinguishable from *canteneraria*.

The other difference between the species and its variety is that *virgularia* is often, and in the London form always, much browner or yellower in ground-colour than *canteneraria*. Of the various colours of ground seen in the hybrid race I have been able to suggest no explanation, though, as already noted, a certain amount of order is discernible, especially in the fact that the males are almost invariably darker than the females.

In regard to size it has been shown that, taken as a whole, the individuals fall into a normal curve of error, but that some of the broods show considerable departures from the normal, for which no explanation in heredity or environment is forthcoming.

It should be mentioned also that both speckled and non-speckled, yellow and white individuals occurred in broods which hibernated as larvæ as well as in broods which passed through their whole development in a couple of months in the summer, so that these differences are not likely to be due to environment, nor are they seasonal forms.

The specimens have been placed, with Messrs. Prout and Bacot's material, in the Hope Department of the Oxford Museum.

Harrison and Sons, Printers in Ordinary to His Majesty, St. Martin's Lane.

[*From* "*The Transactions of the Second Entomological Congress*, 1912."]

ON THE SCENT-PATCHES OF THE PIERINÆ.

By F. A. Dixey, Oxford.

It is well known that the males of many species of Pierine butterflies are furnished with an apparatus for distributing the characteristic odour, which is generally of an agreeable nature, belonging to that sex. This apparatus usually takes the form of specialised scales, which may be either scattered broadcast over the wings, or collected into more or less definite patches. In the former case the scales are as a rule of the kind known as "plume-scales," being provided at the distal extremity with a tuft or fringe of delicate chitinons tubules which appear to be pervious, and so to allow the escape of the volatile substance, probably of an oily nature, which carries the perfume. In the latter case, though the scales may sometimes be of the plume-bearing kind, it more often happens that they are without the plume-like appendage, though they show other evident marks of specialisation when compared with the ordinary scales of the wing. Plume-scales are almost invariably confined to the upper surface of the wings; scent-scales of the other kind may be found on either the upper or lower surface, in many cases on both.

In several species of the genus *Dismorphia* the scent-scales of each wing are collected into an oval patch, usually quite conspicuous, which is situated on the lower surface of the forewing and the upper surface of the hindwing. These patches are so placed that in the ordinary position of rest the forewing patch is superimposed upon the patch of the hindwing, and the escape of the odour from both is presumably thereby prevented. During flight, both patches present a free surface to the atmosphere, and no apparent obstacle exists to the dispersal of the perfume. In *Dismorphia* (*Acmepteron*) *nemesis* each oval patch is surrounded by a smooth, shining area with a silky or pearly lustre, the oval patch itself having a roughened or "chalky" appearance. These differences are due partly

to the size and structure of the scales themselves, partly to the mode in which the scales are inserted into the wing. The scales constituting the oval patch are large, about six or seven times as long as broad, and with sides roughly parallel. Those of the silky area are small, oval or pear-shaped, attached by the broader end. The scales of the oval patch are set up at an angle and overlap ; those of the silky area are arranged like a mosaic and are closely appressed to the surface of the wing. The silky area and chalky patch together occupy about three-quarters of the area of the forewing, and a little less than half that of the hindwing. The object of the silky patches, with their pavement-like arrangement of scales, may be to ensure the smooth sliding over one another and the close fitting together of the surfaces which are apposed during rest. When the silky patches coincide, the chalky patches coincide also, and the insect is in the normal position of repose. It is perhaps conceivable that the sliding together of the two smooth surfaces may give rise to a tactile impression which assists the butterfly in assuming the appropriate attitude. An interesting point is that the ordinary pattern of the wing is not continued on the silky areas, being confined to those regions which are visible while the insect is at rest. This is a strong argument in favour of the view that the wing-pattern has been evolved under the influence of natural selection.

When the wing has been denuded of scales, the position of the scent-patch is still clearly indicated by the more cloudy appearance of the wing-membrane in that situation. On examination this is seen to be due to the presence of the special sockets which serve for the attachment of the scent-scales. These sockets, which are considerably larger in every dimension than those belonging to the ordinary scales of the wing, are confined, as has been seen, to one surface—the lower surface of the forewing, the upper surface of the hindwing. They are very easily distinguishable from the ordinary sockets on microscopic observation, not only by their superior size, but also from the fact that they focus at a different level.

In *Acmepteron virgo* Bates, the male has similar oval patches in the corresponding situation on the fore- and hindwing. The silky area surrounding the oval patches extends even farther

over the wing than in *A. nemesis*, but the boundaries of both area and patch, especially of the hindwing, are less well defined than in that species. This is partly due to the fact that the scales of both patch and area are in the hindwing of nearly the same whitish tint ; while in the forewing the scales of the oval patch are of two kinds, one of which is not confined to the patch itself, but extends beyond the borders of the patch over nearly the whole of that part of the silky area which lies between the first median and the upper radial vein. A result of this arrangement is that the distal border of the patch is somewhat less sharply defined than in *A. nemesis*, and that on a naked-eye view a kind of cloudiness, due to the presence of these widely-dispersed scales, pervades the part of the silky area that has been named. The scales which are common to both patch and silky area may be described as elongate cordate, or club-shaped, tapering regularly towards a narrow proximal extremity, and with the distal border slightly bifid. These are thickly interspersed among the scales proper to the region, which in the scent-patch are elongated elliptical, about five times as long as broad, and smaller in all dimensions than in *A. nemesis*. The scales of the hindwing patch are similar, but less elongated and broader in proportion. Those of the silky areas are much like those in *A. nemesis*, but have the sides more nearly parallel. They are larger on the hindwing than on the forewing. The sockets of both kinds of specialised scales are easily distinguishable microscopically from each other and from those of the ordinary scales clothing the other surface—lower or upper as the case may be. In a denuded wing-membrane the sockets of the ordinary scales appear as simple cups ; those of the specialised scales are ill-defined and somewhat opaque, the latter character seeming to be due to an abundant wrinkling of the wing-membrane in their immediate vicinity. Those of the scales peculiar to the scent-patch are distinguishable by their superior size. Both kinds of specialised scales are altogether absent in the female.

The male of *Dismorphia praxinoe* Doubl. has two large white patches, one occupying about two-thirds of the lower surface of the forewing, the other nearly half of the upper surface of the hindwing. The silky area in this species is not well

defined, but it exists as a comparatively narrow border to the white patch in both fore- and hindwing. The scales composing the white patch are in each case of a specialised kind. In the hindwing they are elongate oval, much like those of *A. virgo*. In the forewing the proximal part of the patch is entirely composed of scales of this character, but distally these become mingled with other scales of the same general type as the club-shaped scales in *A. virgo*, but shorter, less gradually tapering, and with the distal margin simply rounded and not bifid. As in *A. virgo*, scales of this latter kind are continued over the surface of the wing to some distance beyond the edge of the scent-patch. In both species they appear to be absent from the hindwing, where the scales of the white patch are of one uniform appearance. The scales peculiar to the scent-patch are in *D. praxinoe* very heavily loaded with white pigment; apparently much more so than in *A. virgo*. In both species the club-shaped scales are comparatively devoid of pigment, and show a coarsely-meshed chitinous reticulum.

In *Dismorphia fortunata* Luc., the conspicuous white patch on the undersurface of the forewing in the male occurs chiefly on the inner side of the median, and is traversed by the three branches of that vein. It consists almost entirely of a dense mass of long, curving hairs closely matted together, and intermixed with a few oval scales of a type intermediate between the ordinary form and the fully developed hair. These hairs are absent from the hindwing, but the whitish, opaque area of the costal portion upper surface shows a pavement-like assemblage of elongated oval scales, somewhat similar to those of the scent-patches in *A. virgo*.

In *Dismorphia pallidula* Butl. & Druce the scent-patches are well defined. They form oval marks of a brown colour in the usual situation on the fore- and hindwing. The scales composing them are very closely packed, set up on the wing at a considerable angle, and well furnished with pigment. It is noticeable that though they are all of the elongated oval type, those of the forewing are mostly somewhat narrowed towards the proximal extremity, while those of the hindwing have the sides nearly parallel.

In no species of *Dismorphia* or *Acmepteron*, so far as I am

aware, is there any special distribution of air-tubes to the scent-patches. But in several other Pierine genera, *e.g. Catopsilia*, *Colias*, *Teracolus*, the specialised patches, when present, are provided with a plentiful supply of ramifying "tracheæ," somewhat similar to those described and figured by FRITZ MÜLLER in the Satyrine butterfly *Antirrhæa archæa* Hübn. In *Teracolus fausta* Oliv. the male is furnished on the lower surface of the forewing with a well-defined scent-patch. This is pervaded by numerous tracheæ which, starting at right angles from the submedian vein, run roughly parallel to one another through the patch, giving off numerous fine ramifying branches. These latter form a reticulum with hexagonal meshes, the interstices of which appear to correspond with the sockets for the insertion of the specialised scent-scales, there being usually one such socket to each interspace. Besides this reticular structure, still finer ramifications are visible, some of which in a few instances seem to end in connection with the proximal extremities of the scale-sockets.

In *Catopsilia florella* Fabr. the scent-patch on the upper side of the hindwing is well furnished with tracheal branches, the general arrangement of which is not unlike that in *Teracolus fausta*. The main tracheal branches run forward from the subcostal nervure in a row like the teeth of a comb, traversing the scent-patch, and becoming lost to view immediately beyond it. Each socket belonging to a specialised scent-scale occupies a definite area of the wing-membrane; these areas appear to correspond with the hexagonal reticulum in *T. fausta*, but the connection with tracheal ramifications is less evident, and the areas have a rounded rather than a hexagonal contour. Their appearance in a patch denuded of scales is very suggestive of the acini of a racemose gland. A similar arrangement is visible in the corresponding scent-patch of *Catopsilia pyranthe* Linn.

On the underside of the forewing in *C. florella*, the specialised scales take the form of long hairs which are collected into a flattened fringe or tuft lying along the inner margin of the wing, and covering the scent-patch of the hindwing in the ordinary position of rest. The region of the wing occupied by these hairs is also well supplied with tracheal branches, whose

terminal twigs seem to bear a special relation to the sockets of the hairs.

Whether in any of these cases the ultimate tracheal ramifications anastomose, I am unable to say. The appearance in *Teracolus fausta* is strongly suggestive of anastomosis, but I find no absolutely clear evidence on the point. The finest terminal twigs are not easily traced, and even the larger capillaries, unless they happen to contain air, can only be followed out with considerable difficulty.

The significance of the special distribution of tracheæ to the scent-patches and hair fringes is a matter of conjecture, but that it has some reference to the scent-producing and scent-distributing function of these structures seems certain. It is noteworthy that the fringe of hairs in *C. florella*, which is free from any admixture with scent-bearing scales like those of the patch on the hindwing, is nevertheless well furnished with air-tubes; and the suggestion may be hazarded that their presence may assist in some way the erection of the hairs or the dispersal of the perfume. But in any case their entire absence, so far as has been observed, from the scent-patches in *Acmepteron* and *Dismorphia*, is not easy to explain.

Some of the points dealt with in the present paper have been noticed by FRITZ MÜLLER, and reference may be made to the English translation by Mr. E. A. ELLIOTT of his Papers on the Scent-organs of Lepidoptera, lately published by Dr. G. B. LONGSTAFF as an appendix to his book *Butterfly-hunting in Many Lands*.

The paper was illustrated by lantern slides of most of the structures described.

[*Extracted from the* LINNEAN SOCIETY'S JOURNAL—ZOOLOGY, vol. xxx. *October* 1907.]

A few Notes on South African Chamæleons, &c. By G. B. LONGSTAFF, D.M., M.A., of New College, Oxford, and EDWARD B. POULTON, D.Sc., M.A., F.R.S., Hope Professor of Zoology in the University of Oxford, and Fellow of Jesus College, Oxford.

[Read 7th March, 1907.]

THE following observations were made during the visit of the British Association to South Africa in 1905. The conditions were not favourable to continuous investigation: nevertheless, I believe that some of these scattered notes are not without interest, especially those referring to the automatic adjustable countergrading of shadow on the two sides of the chamæleon. It is probable that the independent control of the colours of the two sides of the body has been often observed before, but, so far as I am aware, this is the first attempt to explain the significance of the power. The illuminating effect of a great hypothesis like that of Mr. Abbott H. Thayer's in the realm of protective coloration is well seen in the fact that Dr. Longstaff, Professor C. V. Boys, and the present writer independently grasped the meaning of the colour-change the moment it took place before their eyes. I do not know whether my two friends have studied Mr. Thayer's writings or examined his beautiful models at London, Oxford, or Cambridge *, but I have no doubt that it is the result of his work that interpretation was "in the air."

I have to thank Mr. G. A. Boulenger, F.R.S., for kindly naming the specimens upon which the following observations were made.—E. B. P.

1. *Note on* CHAMÆLEON DILEPIS, *Leach*, ♀. *By* Dr. G. B. LONGSTAFF.

The chamæleon was taken near the Waterworks, Bulawayo, Sept. 9th, 1905 (about 3–4 feet from the ground), on a shrub of *Dombeya* (? *rotundifolia*), the white flowers of which were attracting a number of insects of various orders. I was startled on detecting the animal, which at first escaped my notice.

Description.—Pale yellowish grey, legs and tail darker; streaked and blotched with greenish grey. Throat with six cadmium-yellow stripes. A yellow spot behind the shoulder, another over the ribs, and a yellow lateral line.

It gives vent to a gurgling hiss when disturbed, and once bit me, but not hard.

Kept alive and observed at Victoria Falls, Sept. 16th, 1905. Placed on a plant of young Acacia, the animal soon lost all its darker bands and became almost uniform grey-green, with the above yellow markings. In the

* [I was familiar with Mr. Thayer's models.—G. B. L., July 17, 1907.]

sun it became strongly mottled, with some tendency to be paler on the shady side, but this was not very marked. Excrement consisted of elytra and other insect-fragments.

When chloroformed, it became a uniform pale yellowish, a little paler than my khaki coat: that is to say, assumed its *palest* coloration.

2. *By* Professor E. B. Poulton.

A fine specimen of *Chamæleon dilepis* was found by Mr. A. D. Hall at a station on the railway, Sept. 11th, the day before reaching the Victoria Falls. The chamæleon was hiding in the deserted nest of a weaver-bird. Mr. Hall kindly gave the specimen to me. It lived in its nest on the train and on the steamer for two weeks without making any attempt to escape. During all this time the chamæleon remained of a straw-colour, which admirably matched the tint of the nest. When removed from the nest and placed on various surfaces its colours did not change. It refused all food, and was probably passing through a dry-season hibernation. In about a fortnight its colour became greenish, it drank, and on one occasion began to wander. Finally, on Sept. 29th, it took the first meal, devouring spiders and insects with the utmost avidity. Its chief food throughout the long voyage was the special cockroach of the 'Durham Castle,' *Phyllodromia germanica*, of which it must have eaten hundreds. Having once begun, the chamæleon maintained its appetite, until in the late autumn it was deposited in the Zoological Gardens, where it unfortunately died in the winter. The existence in the dry season of a fasting period, during which the colours are steadfast, was unknown to me and, if hereafter confirmed, would appear to be a fact of considerable interest in the life of this species of chamæleon.

3. *Note on* Chamæleon pumilus, *Daudin*, ♀. *By* Dr. G. B. Longstaff.

Taken on a shrub, about four feet from ground, in the Botanical Gardens, Cape Town, 9th August, 1905.

Description.—Apple-green; at the back of the eye two patches of greyish-pink placed vertically; a lateral stripe of the same colour extending from shoulder to pelvis, widest in middle, where are two dark grey spots. Several orange tubercles on the back. Belly striped with greenish white; underside of head striped blue-green and pink. The ground varies to dusky green.

Kept in confinement. Observations on same made at Durban, 16th Aug., 1905. After it had been kept for some time in the dark it became of the brightest apple-green. On exposure to light it darkened. Placed on a dark "uniform-case" near the window in bright light it darkened *along the dorsal area.*

Taken out into the garden and placed alternately on a black pair of trowsers and on a white towel. It darkened in both cases, but there was no

noticeable difference. Then put on a twig of a shrub with bright green leaves it became paler. The side *away from the sun* was of the brightest apple-green, the outer side (towards the sun) was *darker along the back.* The bright green harmonized wonderfully with the young leaves, the creature appeared flat, and was scarcely distinguishable. The neck and belly did not appear to change colour.

It was then killed, being rapidly overcome by chloroform, then becoming more dusky than seen previously: that is to say, it assumed its *darkest* coloration. If the result in the first case was paralytic in its nature, it would appear in the second case to have been stimulant; or *vice versâ.*

4. *By* Professor E. B. Poulton.

Three specimens of *Chamæleon pumilus*, two large and one small, were kindly given to me by a keen naturalist friend, Miss Molly Jenkins, the daughter of my kind host, Rev. Canon Jenkins, D.D., Principal of the Diocesan College, Rondebosch. The small individual soon died, and one of the others did not live long. The third was a very healthy specimen, and upon it the following notes were made. The behaviour of *C. pumilus* afforded the strongest contrast to that of *C. dilepis*, for, with few exceptions, it accepted food whenever offered. The exceptions are of considerable interest. On one occasion it was offered the spinous reddish caterpillar of an *Acræa*, which it made heroic efforts to eat, but finally rejected. At another time a hard rough brown weevil (almost certainly *Spartecerus rudis*, Fâhr.) was seized and instantly abandoned. When it is remembered that both Acræas and weevils are mimicked by species belonging to other and very different groups, the behaviour of the chamæleon is seen to be highly significant. It would be deeply interesting to experiment further and attempt to ascertain whether the weevil was rejected because of the instant recognition of its excessive hardness *, or on account of some other special protection. *C. pumilus* devoured the cockroaches on the ship, but was not nearly so fond of them as its larger relative. Flies appeared to be its favourite food. This specimen was also deposited in the Zoological Gardens, where it lived for some weeks longer than *dilepis*. It died about New Year's Eve.

Good fortune gave me as companions in the same compartment of the train two physicist friends, Captain Creak, F.R.S., and Professor C. V. Boys, F.R.S. One day, when *C. pumilus* was resting on the compartment table, with the long axis of its body parallel to the window, Professor Boys, who was certainly intended for a naturalist, pointed out that the strongly illuminated side, next to the window, was dark green, while the side in deep shadow, away from the light, was of the brightest tint. The same relationship between the illuminated and the unilluminated side was seen on many occasions.

* See Trans. Ent. Soc. Lond. 1902, pp. 322–25.

This appears to be a most interesting adaptation—a dynamic manifestation of the principle discovered in its static form by Mr. Abbott H. Thayer. Mr. Thayer first suggested that the relative shades of the dark back, lighter sides, and white under sides of animals were such as just to counterbalance the diminution of natural illumination from an open sky as we pass from the back down the sides to the under surface; that the object of this countergrading was to neutralise the shadow which would otherwise render the animal conspicuous. *C. pumilus*, as I have said, manifests the same principle in a dynamic form. The side that happens to be turned away from the light is brightened sufficiently to neutralise the shadow; the high illumination of the other side is toned down by darkening, the effect being that all appearance of solidity is dissipated. This result must be of great importance to so large and so defenceless an animal as the chamæleon. But for this adjustable countergrading, the varying degrees of illumination on the side and dorsal slope turned towards the light, combined with the strong shadow on the other side, would cause it to stand out among the leaves as an object of conspicuous solidity and thickness.

5. *Note on the Vitality of the Tail of a South African Gecko*, PACHYDACTYLUS MACULATUS, *A. Smith*. *By* Dr. G. B. LONGSTAFF.

The Gecko on which the following observations were made was found under a stone on Hlangwana Hill, Colenso, 24th August, 1905.

Sluggish; eyes large. Body dull pale brown, with a conspicuous row of dark brown spots on either side of the back, outlined with black and outside that with pale ashy; belly flesh-colour.

When chloroformed, the short stumpy tail was cast off (causing slight hæmorrhage), and took much longer to die than the body, wriggling with a spiral movement.

[The vitality and activity of the tails of lizards after they have been cast off are, I believe, an adaptation for the purpose of aiding in the escape from a pursuing enemy. The tail becomes for the moment a more lively and interesting object than the lizard itself, and is likely to distract the attention of an enemy. It is probable that the phenomena are not to be explained merely by the temporary maintenance of vitality in the tissues of an amputated part, but that the special activity manifested is due to accumulation through natural selection. See Proc. Bost. Soc. Nat. Hist. vol. xxvi. 1895, p. 388.—E. B. P.]

[The persistence of movements in the tail under the special conditions described above was doubtless mainly due, as suggested in the discussion by the President, Professor Herdman, to the fact that the amputated part had lost its connection with the respiratory and circulatory organs, by means of which the chloroform is conveyed to the tissues.—E. B. P., July 12, 1907.]

[Professor Herdman's explanation is doubtless the correct one, and tallies with the fact that active insects, such as Humble-bees, succumb much more rapidly to volatile poisons than more sluggish Beetles of the same size. At the time, however, I connected the greater activity of the tail with the absence of a brain.—G. B. L., July 17, 1907.]

[*From "Novitates Zoologicae."* *Vol. XI.* *March*, 1904.]

ON A LARGE COLLECTION OF RHOPALOCERA FROM THE SHORES OF THE VICTORIA NYANZA.

By S. A. NEAVE, B.A., F.E.S., Magdalen College, Oxford.

(Plate I.)

THE following list of butterflies comprises the collection made by Mr. C. A. Wiggins from the end of October 1902 to the end of May 1903 on the shores of the Victoria Nyanza. The specimens were collected either by him or by native boys under his direction. Mr. Wiggins' headquarters were at Kisumu, 3800 ft., situated close to the terminus of the railway. The country around Kisumu is mostly open plain, without even scrub, but here and there patches of woodland whence come a large number of the Pierines. Mr. Wiggins collected from two localities south of Kisumu—the Kalachonyo Plain, a large open plain some ten miles south along the shore, 3750 ft., and in the Ugaia country, 3800 ft., which is on the other or south side of the Kavirondo Gulf, and seems to have been partly woodland. Nyangori is a few miles north and a little east of Kisumu, and is forest land, height 5000 ft. The Tiriki Hills are still farther north, about twenty miles from Kisumu, and covered with dense forest, height 5100 ft. Mr. Wiggins describes catching many of the Tiriki specimens "at one spot about ten yards square, by a river of shallow mud and water in the forest. To get to it I had to wade for two hundred yards up to my waist in a swamp of black mud." The Usemi specimens come from an open plain some fifteen miles west of Kisumu on the lake shore, height 3800 feet. Mr. Wiggins describes it as "open plain, no scrub except euphorbia trees round old villages."

Entebbe is 160 miles west of Kisumu, on the N.W. shore of the lake, upon some hills about 4000 ft. above the sea. The country is open plain, with here and there patches of dense forest.

The Toro specimens were captured by natives for Major Rattray, who gave them to Mr. Wiggins. They come from the Toro country, on the eastern slopes of the Ruwenzori Mountains, 7000 to 9000 feet., the country being apparently in large part woodland or forest.

In the following tabular statement * of species and numbers I have arranged the localities from the Ugaia country, on the east shore of the lake, along the north shore to Entebbe on the N.W. shore, and lastly the Toro country still farther west. As will be seen, the last two localities are the most distinctly western in character, lying as they do on the eastern outskirts of the great western Equatorial Forest. At the same time outlying patches of forest country, such as the Tiriki Hills, near the N.E. shore, produce very many western species, though also containing certain peculiar forms. It would therefore seem, though further evidence on the subject is required, that the escarpments east of the lake form a more distinct line of demarcation between eastern and western species than the lake itself.

* See pages 344—363.

For the help and assistance given me in the identification of the large number of species in the following tables I wish to express my best thanks to Mr. F. A. Heron, of the British Museum; Dr. K. Jordan, of the Zoological Museum, Tring; to Dr. F. A. Dixey, Wadham College, Oxford, for special help with the Pierines, and Mr. H. H. Druce with the Lycaenids. I should also like to express my thanks to Miss E. M. Bowdler Sharpe for kindly permitting me to make comparisons with her types; to Mr. Roland Trimen, F.R.S., for most valuable suggestions and criticisms; and to Professor E. B. Poulton, D.Sc., F.R.S., of the Hope Department, Oxford University Museum, for the most kind advice and suggestions throughout the production of the paper. I wish above all to express my sincere thanks to Mr. C. A. Wiggins for the manner in which he has answered all the numerous questions addressed to him and at the same time to put on record my deep indebtedness to his remarkable energy as a naturalist.

It has not been possible, through lack of time, to give the sexes of every species, especially in cases of very large numbers, though I have endeavoured to do this wherever feasible.

In the order of species and in nomenclature I have followed in the main Prof. Chr. Aurivillius's standard work and Messrs. Rothschild and Jordan's papers on African butterflies.

DESCRIPTIONS OF NEW SPECIES.

Amongst the new species I have described are two or three kindly lent me by Mr. Roland Trimen. They were captured by Mr. C. W. Hobley, of Kisumu, in that district. I have also taken the opportunity of describing a new Acraea recently sent to the Hope Department by Mr. H. A. Byatt, from Angoniland. The other new species are all in the collection of Mr. Wiggins.

Unless otherwise stated, all types are in the Hope Department, Oxford University Museum.

NYMPHALIDAE.

DANAINÆ.

1. **Amauris dira** spec. nov. (Pl. I. f. 1).

♂. Glossy black with white spots.

Upperside.——Forewing: in discoidal cell placed a little beyond the middle and nearer the posterior border, a very small spot. Below cell, between the first and second median nervules, both of which bound it, is a large rectangular spot. This is by far the largest and most striking spot in the wing. At the extremity of the cell and above it is a small spot. Just beyond this and beneath costa is another small spot, rather long and narrow. This spot is the first of a row of four spots which cross obliquely the apical portion of wing to distal margin. Of this row, the second is the largest, and the third, which is somewhat indefinite and may be evanescent, is close to it. The fourth is close to the distal margin, and lies just under the third radial nervule. Near apex are two small white spots, of which the one nearest the costa is the larger. There are also near the distal margin two more spots placed beneath the second and first median nervules

respectively. There are two or three minute evanescent dots close to the distal margin about its middle. Fringe black, with small white internervular patches throughout the middle of the distal margin.——Hindwing paler in colour than forewing. Crossing the cell near but not quite up to its base is a whitish patch; beginning at the anterior border of the cell, it extends across its posterior border to the inner angle of the wing. In breadth it extends rather beyond half the length of cell. Just below costa beyond extremity of the cell is a spot, and there are three more small spots at the beginning of and following the course of the distal margin. There is also a fourth sometimes indefinite spot near the distal margin just beneath the third radial nervule. Fringe as in upper wing.

Underside very much as upperside, except that apex of forewing is paler in colour and all spots are more pronounced. The spot in the discoidal cell of the forewing has a small projection extending towards the costa. In the hindwing traces of more submarginal spots appear.

Expanse: 78—83 mm.

1 ♂ from Nyangori, 1 ♂ Tiriki.

Evidently near *A. hecate* Butler in shape, and *inferna* Butler in markings.

A. dira can be distinguished at once, however, by the minuteness of the spot in the cell of the forewing, and by the large spot between the first and second median nervules, which is more rectangular in shape than in *A. hecate.*

ACRAEINAE.

2. **Acraea cinerea** spec. nov. (Pl. I. f. 16).

♂. *Upperside.*——Forewing vitreous in the middle, but dusted with dusky black scales along the costa, across the apex, and along the distal margin. This dusky border is of considerable breadth in the region of the apex, reaching to the end of the discoidal cell, but narrows rapidly along the distal margin, ceasing at the posterior angle.——Hindwing dusted thickly and uniformly with dusky black scales of the same colour as in the forewing. In the internervular spaces external to the cell, especially on each side of the discoidal nervule, a small number of scales of a brick-red colour. These are almost invisible in some specimens.

Underside much as on upperside, but the costa of the forewing for nearly two-thirds the length of the cell of a brick-red colour, this tint being more marked towards the base. On the hindwing this colour is distributed over the basal area; it fills up the distal area of the cell, being bounded on its inner side by a black spot which is situated about the middle of the cell. The brick-red colour also fills up the spaces on each side of the submedian nervule for about half its length. In each of these spaces toward the base is a small black spot, and there is a row of three spots bounding the limit of the red area, the first one above the second median nervule. These spots are liable to differ considerably in intensity. Fringe uniformly black.

♀ differs in slightly larger size, and in the spotting of the hindwing being much heavier and visible from the upperside. There is an additional spot at the extremity of the cell, making the fourth of the row, and another at the base of the cell.

Expanse, ♂, 40 mm. : ♀, 45 mm.

Six specimens from the Tiriki Hills, 5 ♂♂, 1 ♀.

This peculiar little species, with its long narrow wings, has apparently its nearest allies in forms like *A. iturina* and *A. quirinalis* of Grose-Smith.

3. **Acraea wigginsi** spec. nov. (Pl. I. f. 3).

♀. *Upperside.*——Forewing: The actual base of costa, a narrow line within cell above median nervure, space below median nervure and down to the submedian nervure are all of a dull red colour slightly dusted with dusky scales; the base of wing and the rest of costa, apex and distal margin of the wing fuscous black. A large black spot in the discoidal cell near its extremity, another in an oblique line with this below median nervure, and a pair of confluent spots below the second median nervule in the same line. These latter bound the distal limit of the red area of the forewing. At the extremity of the cell in its upper part two confluent spots, and beyond these two more. These last two spots form the inner boundaries of a broad white subapical bar. This bar is divided into five parts by nervules which cross it. The fifth part, *i.e.* between third radial and first median nervules, is less well defined than the others. Along margin and upon it there are brownish spots in the internervular spaces, becoming paler as they approach the posterior angle. Below the submedian nervure is a black streak shading to reddish toward the posterior angle.——Hindwing has two black streaks at base, one being within the cell. Rest of wing red shading to orange, red toward margin, one spot in cell near its extremity and one just below it; a row of these small spots beyond and above the extremity of the cell; a narrow black border inclosing seven small pale yellow spots placed between the nervules.

Underside paler. Red colour of forewing more extensive, apex greyish with black nervules, and pale brown internervular streaks along the margins; of these the one between last subcostal and first radial nervule is much the longest, running in as far as the white subapical bar.——Hindwing pale buff. At the base above the precostal and below the median nervures are bright pink patches. A ring of five patches of the same colour and somewhat rectangular shape surrounds the end of the cell, while the second and largest of these includes its extremity. Each of these patches is bounded both proximally and distally by black streaks; the narrow and black festooned distal marginal band encloses eight semilunar spots of a creamy white colour. There is a slight invasion of black colour along the nervules, and between these projections are patches of a reddish brown colour. Abdomen greyish above, paler below; the fringe black on forewing, grey on hindwing.

Expanse, 53 mm.

1 ♀, Tiriki Hills, March 20th, 1903.

1 ♀, Kisumu, end of May 1903.

This remarkable species is evidently related to *A. bomba* Grose-Smith, and it is possible that these specimens, being evidently mimetically associated with *A. encedon* L. and *L. chrysippus* L., may have a ♂ still more closely resembling *A. bomba*.

4. **Acraea doubledayi equatorialis** subsp. nov.

♂♀. The specimens present some points of distinction from either the typical or *axina* Westw. forms.

♂. The dusky suffusion at the base of both wings and the black border are both considerably reduced. The two small spots near the apical angle of the forewing, present in *doubledayi*, absent from *axina*, may or may not be present. The black internervular subapical and distal marginal streaks (2—3 in *doubledayi*, 3—4 in *axina*) are always five in number, with sometimes traces of a sixth. These characters apply to both sexes. The ♀ also differs in its remarkably pale colour.

Of 22 ♀♀, 10 have white hindwings with greyish white forewings, and the rest are considerably paler than southern forms, being mostly more or less suffused with white. The white bar in the forewing resembles that in the *axina* form.

Taking all the characters into consideration, this may be looked upon as an extreme form of *axina*, or rather that *axina* is intermediate between the typical *doubledayi* and this form from the Victoria Nyanza.

5. **Acraea mystica** spec. nov.

♂. Brick-red and pink with black markings.

Upperside.——Forewing: ground-colour brick-red with an orange tint, a narrow, almost linear, black margin, even at apex. The following spots: one within the cell, a little beyond its middle; one at the upper part of extremity of cell. Beyond cell an oblique row of five spots, of which the last, situated below third radial nervule, is separated from the rest. Below extremity of cell, two spots above and below second median nervule, and nearer base a small spot below median nervure. A pale subapical bar beyond oblique row of spots. Crossing apex and along distal margin five black subapical and submarginal internervular streaks, of which the lowest is paired.——Hindwing: ground-colour bright pink. Heavily black at base, with a black border of medium breadth slightly serrated inwardly. The following spots all rather reduced: two beneath costa, two within cell, one at upper part of extremity of cell, one near base below median nervure. A highly irregular discal row of rather small spots crosses wing, eight or nine in number, of which the third and fifth are nearest the base of the wing.

Underside.——Paler, spotting much as on upperside. Forewing has light brown subapical and submarginal streaks. Hindwing has fenestrated black margin, enclosing seven semilunar spots of a pale greyish colour. Abdomen white.

Expanse, 63 mm.

One rather worn ♂ from Kisumu, March 1903.

Closely allied to *A. sykesi* Sharpe and *A. doubledayi* Guérin in character of spotting and marking, but differs in much larger size and brilliance of colour, which must be very marked in a fresh specimen.

6. **Acraea clarei** spec. nov. (Pl. I. f. 4).

♂♀. Red and rosy pink with black markings and borders.

♂. *Upperside.*——Forewing brick-red, shading to black from extremity of cell

to apex. Slightly dusky at base. In the discoidal cell rather beyond its middle an elongate spot somewhat variable in size. At extremity of cell at its upper part two rather confluent spots. Parallel with the end of cell and just beyond it an oblique row of five spots more or less confluent into a bar. Below the cell, nearly in a line with its extremity, are two spots, one on each side of the second median nervule. Nearer the base and below the median nervure is another spot. The black border along the costa is linear. The subapical portion of the wing is a semitransparent grey colour, shading to black at apex, being interrupted, however, by four internervular reddish brown streaks which cross the apex obliquely. The fourth reaches and touches the distal margin between the first median and third nervules, being bounded inwardly by a submarginal spot. There are similar submarginal spots below the first and second median nervules.——Hindwing a brilliant rosy pink, dusky at base, shading to a brick-red toward the margins. Two spots beneath the costa. Two spots in discoidal cell, the outer one the larger ; one at the upper part of extremity of cell, and one below median nervure. An irregular row of nine spots crosses the discal area of the wings, which are alternately nearer and farther from the base. All or any of these spots on hindwing may be evanescent and only show by transparency from the underside. The festooned border of the distal margin is also visible in this way. The margin is black, but of variable width.

Underside paler than upperside. Apex, instead of being black, is yellowish, with black nervules and ochreous brown internervular streaks. Spotting of forewing *less* and that on hindwing *more* pronounced than on upperside. Hindwing has a festooned black margin inclosing seven creamy yellow spots, with a trace of an eighth spot at the anal angle. Base dusted with bright pink scales, and the internervular spaces along the distal and inner margins have slight submarginal streaks of the same colour.

Fringe black, except on the inner margins of both wings, where it is yellowish.

Abdomen reddish brown above, shading to whitish beneath.

♀ much like the ♂, duller in colour, with spotting and borders, and suffusion of black at base of the wings heavier. Internervular streaks across apex of forewing whitish. Rosy pink of hindwing in ♂ replaced by brownish ochre.

Abdomen black above, spotted with whitish beneath.

Expanse : 58 mm.

Tiriki Hills, March 18th, 1903, 1 ♂. Type.

Nyangori, November 1—8, 1902, 1 ♂ ; March 25th, 1903, 1 ♀.

Entebbe, April 1—12, 1903, 2 ♂♂, 2 ♀♀.

This beautiful species is allied to *A. pseudegina* Westw., but the ♂♂ especially are much less sombre in colour.

7. **Acraea byatti** spec. nov. (Pl. I. f. 17).

♂. Allied to *serena* Fabr., *ventura* Hew. and *excelsior* Sharpe.

Orange scarlet with black borders.

Upperside.—— Forewing : black at the base ; costal margin extending into the upper part of cell, apex and distal margin all black. A subapical orange-red bar, divided into four portions, of which the one beneath the costa is paler in colour, lies in the black apical area. This black area just before the extremity of the cell leaves the subcostal nervure, turns at right angles for a short distance toward the inner

margin, and includes the greater part of extremity of cell, then turning again to its previous direction. Marginal border black and heavy, narrowing somewhat as it approaches posterior angle. All central portion of wing brilliant orange-scarlet. A small black streak runs from the base beneath submedian nervure nearly half-way to posterior angle.——Hindwing: base dusky black, including nearly half cell; central portion of wing orange-scarlet, shading to yellow toward inner margin, which is paler near the base. A black spot at the upper part of extremity of cell. Distal marginal border broad and black, but does not follow shape of wing, as its inner edge makes nearly a right angle in the space between last subcostal and radial nervules.

Underside.——Forewing: no black at the base, central red area as on upperside but rather duller in colour. Costa dusky yellow, apical bar buff-colour, apex greyish yellow, with black nervules and red-brown internervular streaks.——Hindwing: basal and discal areas pale buff. A black spot at base of cell, another at upper part of its extremity. A red patch above the costa surrounding the precostal nervure. A red streak above extremity of cell, bounded proximally by a black streak and distally by three confluent spots. Filling space between median and submedian nervures for two-thirds of distance to distal marginal border is a red streak, with two spots situated in its middle, and bounded by a row of four black spots, extending from median nervure to distal margin, of which the central two are confluent Between this red streak and distal margin a small black streak along base of internal nervure and three small spots. The broad distal marginal border the same shape as the upperside, and edged internally by a narrow black line; the nervules are black edged on each side with grey, this being in its turn outlined with black, drawn to a point at the edge of the wing. The intervening spaces filled with brick-red streaks, widening out at edge of wing into nearly triangular patches of a pale yellow colour.

Fringe, forewing black, hindwing yellowish.

Expanse, 43 mm.

3 ♂♂ from Dedza, Angoniland.

Collected in April and June 1903 by H. A. Byatt, B.A., of Lincoln College, Oxford, after whom the species is named.

8. **Acraea oreas** Sharpe f. **albimaculata** nov.f.

This form of *oreas* only differs from typical specimens in having white spotted forewings.

4 ♂♂, Tiriki Hills, March 1903.

NYMPHALINAE.

9. **Neptis conspicua** spec. nov. (Pl. I. f. 15).

♂♀. Brownish black, with white bands.

Upperside.——Forewing: beyond the cell a slightly curved white band, extending from costa to second median nervule, divided into six spaces by crossing nervules; the space immediately beneath the costa very small. On inner margin a little before the end of band a semicircular spot, crossed by submedian nervure

A very faint discal streak, lighter than the ground-colour, follows the outer edge of the band. Along distal margin a triple row of white lines. Near costa the inner row broadens out somewhat.——Hindwing: a broad white stripe, continuous with the semicircular patch on inner margin of forewing, crosses the central portion of the wing; divided into seven portions by crossing nervures. A faint discal and three marginal stripes as in forewing. Distal margin of both wings serrated; fringe black, with white internervular patches.

Underside: ground-colour paler. All white markings much more pronounced and better defined. Additional markings are: on forewing, costa white at base; near extremity of cell two rather faint transverse whitish streaks; on hindwing, costa to a little before its middle broadly edged with white; two whitish streaks cross base of wing.

Expanse, 47 mm.

Nyangori, 1 ♂, 1 ♀, November and December 1902.

Entebbe, 1 ♂, April 1903.

Evidently closely allied to *N. agatha* Cram., but all the white markings more definite, the bars and marginal streaks showing no tendency to be broken up into spots. No spots in the cell.

10. **Neptis clarei** spec. nov. (Pl. I. f. 2).

♂ ♀. Black, with white markings.

Upperside.——Forewing black. Beyond extremity of cell two confluent elongated white spots, with a faint trace of a third above first radial nervule, forming a short broad somewhat oblique bar. Below, and somewhat beyond extremity of this bar, are two more white spots below the third radial and first median nervules respectively. Upon inner margin a little before these spots, a semicircular white spot crossed by submedian nervure. External to bar and spots, and following their course, a very faint streak. Along distal margin three white linear stripes, of which the inner is best defined, especially at apex, and the outer very faint.——Hindwing: a broad white bar continuous with the inner marginal semicircular mark on forewing, divided into eight parts by traversing nervules, crosses to inner margin. One pale discal streak and three marginal ones, as in forewing.

Underside.——Ground-colour paler, and white markings more extensive. Forewing has two streaks across cell near its extremity; bar extends to subcostal nervure.——Hindwing: costa broadly white at base. Two white streaks cross the base of the wing. Distal margin slightly denticulated.

Fringe black with white internervular patches.

Expanse, 55 mm.

1 ♂, Entebbe, April 1903.

Nearest to *N. strigata* Auriv., from which it differs in absence of white patch in cell of forewing, in smaller size of bar beyond extremity of cell, and in the bar of hindwing being narrower.

11. **Neptis ochracea** spec. nov. (Pl. I. f. 5).

♂. Dusky brown with ochre-yellow markings.

Upperside.——Forewing dusky brown with ochreous yellow subapical bar divided into three parts, the one below the costa being very minute.

Beyond the cell another broad bar sloping obliquely back toward the base of the wing. This bar begins below the third radial nervule, and extends to inner margin. It consists of four parts, the third being invaded by some of the dark colour from distal margin. Along hindmargin are traces of black internervular streaks.——Hindwing has a broad ochreous yellow band crossing it to inner margin, being a continuation of the bar on the forewing. Base dusky. Distal marginal band is broader than on forewing, and has the black internervular streaks proportionately longer.

Underside is much paler ; the bars of a pale buff colour, which is suffused to a brownish yellow over the rest of the wings. The black distal marginal internervular streaks remain in both wings.

Expanse, 49 mm.

1 ♂, Entebbe, April 9th, 1903.

This species is allied to *N. exaleuca* Karsch and *N. woodwardi* Sharpe, resembling the latter in colour and the former in distribution of markings.

12. **Pseudacraea hobleyi** spec. nov.

♂. Nearly allied to *kuenowi* Dew. Band on *upperside* of forewing paler in colour, not widened out immediately beneath costa and only just invades extremity of cell. Band is at its widest between the third radial and first median nervules, below which it again becomes somewhat narrower. This gives it almost the shape of a right angle. There are four black spots in the cell and one rather indefinite one about the middle of its extremity. One spot below median nervure near base. Rest of wing the same blackish brown as in *kuenowi*. There are black internervular streaks in apical region, and between submedian nervure and second median nervule is a paired internervular streak crossing orange-yellow band into median area of wing.——Hindwing red-brown at base. Across its middle is a white bar attaining its greatest breadth at inner margin, narrowing as it approaches costa, which it does not quite reach, differing in this point from *kuenowi*. Three black spots in the cell (the largest at the base), and one at the extremity of the cell. This and the outer of two spots placed just above the extremity of the cell are the only spots situated in white area. Distal margin brownish black with well-marked internervular streaks invading white area. As on forewing, the streak between submedian nervure and second median nervule is very long and paired ; the upper of these ends at the base of the wing in a spot. No ochreous colour at the anal angle.

Underside much as in upperside.——On hindwing a large spot on each side of precostal nervure. The inner of these with the spot at the base of the cell in each wing has a white dot on it. The white band more suffused over the distal margin than in *kuenowi*. Abdomen reddish ochreous, black on dorsal surface, spotted with black laterally.

Expanse : 71 mm.

2 ♂♂, Entebbe, April 1903.

A ♀ of this species has been kindly lent me by Mr. Roland Trimen. It was captured by Mr. Hobley of Kisumu, at Nyangori, and the species has been named after him. It differs in slightly larger size and in greater width of orange bar of forewing.

13. **Pseudacraea tirikensis** spec. nov. (Pl. I. f. 14).

Dusky black with white markings.

Upperside.——Forewing dusky black, brownish black towards apex. A black spot at base of cell, two more within it. A black spot beneath median nervure. Just beyond extremity of cell an oblique white bar crosses subapical portion of wing. This bar begins at costa and extends to halfway between first and second median nervules. In one specimen this bar slightly invades angle at upper extremity of cell. In middle of dusky distal margin is a semicircular patch dusted with white scales. This patch sometimes extends up to the extremity of the white bar. Black internervular streaks in apical region. Two such streaks between submedian nervure and second median nervule.——Hindwing dusky brown, slightly redder-brown at base, with a broad white bar crossing discal area of wing, widening as it approaches inner margin. One spot at base of cell with a white dot upon it, two within cell, and one at its extremity. One near base below median nervule. Along inner margin and at anal angle a line of ochreous colour. Black internervular streaks as in forewing.

Underside.——In forewing a small additional spot **near**, and another **at** extremity of cell. Apex lightly dusted with ochreous.——In hindwing across base a triangular patch of a rich red brown, which does not quite reach extremity of cell. Four additional black spots in internervular spaces immediately above cell.

Expanse : 73 mm.

One specimen (? ♀) of this species differs in the white bar of forewing being heavier and broader. It invades angle at upper part of extremity of cell and reaches down to the second median nervule. On the hindwing white discal bar does not extend so near anal angle, and there is no ochreous colour on distal margin except a trace on underside at anal angle.

Fringe black except on the inner margin of hindwing, where it is ochreous. Abdomen black above, reddish ochreous with black spots beneath.

Expanse : 80 mm.

2 ♂♂, Tiriki ; 1 ♀, Toro.

Mr. Wiggins has since sent another ♂ of this species from Nyangori, July 6—18, 1903.

14. **Pseudacraea terra** spec. nov.

Allied to *eurytus* Linn.

♀♂. Dusky brown, heavily marked with dull ochreous yellow.

Upperside.——Forewing : Base of costal margin down to median nervure, apex, and distal margin dusky brown, with darker internervular streaks in apical region. A black spot with a white dot upon it at base of cell, and two more just before middle of cell. Beyond cell a broad, subapical, oblique, rectangular, ochreous yellow bar, divided into five parts by nervules traversing it. This bar extends from costa to midway between third radial and first median nervules. Below the median nervure near base a black spot, which marks inner boundary of a broad ochreous yellow area, which starts below first median nervule and widens rapidly as it approaches distal margin.——Hindwing at base of costa dusky brown. At

base of cell a large black spot with a white dot upon it. Two spots in cell, one at its extremity and two minute ones just above its extremity. Distal margin dusky brown, narrowing as it approaches anal angle. Rest of wing ochreous yellow with strongly marked dark internervular streaks. There are two such streaks between submedian and median nervures, of which the outer ends in a spot near base of wing.

Underside very like upperside, but on hindwing two additional spots above the basal portion of cell.

Expanse : 81 mm.

This species is an extraordinarily close mimic of *Planema tellus* Auriv.

1 ♀ in British Museum from Uganda, *type*. 1 ♂, Entebbe, Uganda.

15. **Pseudacraea obscura** spec. nov.

♂ ♀. Dusky brown dusted with lighter brown.

Upperside.——Forewing dusky brown. One black spot at base, two in the middle, one near and one at extremity of cell. Beyond cell a narrow oblique subapical bar of a yellowish buff colour, which extends from subcostal nervure to half-way between third radial and first median nervules. Upon inner margin, and extending just above second median nervule, is a somewhat triangular area dusted with ochreous red scales. Dark internervular streaks in apical region, with a double streak between submedian nervure and second median nervule.——Hindwing dusky brown, suffused with redder brown, especially towards anal angle. Spotting as on forewing, with two additional spots above extremity of cell. Dark internervular streaks on distal margin.

Underside paler throughout than upperside. Hindwing a uniform ochreous brown, with two additional spots above base of cell.

♀. Larger, generally paler in colour. Subapical bar of forewing rather larger and whitish in colour. Ochreous patch extending from distal margin paler than in ♂, but more pronounced, and filling up the angle formed by the median nervure and first median nervule. The spots in cell of forewing smaller.

Expanse : ♂, 72 mm. ; ♀, 81 mm.

1 ♂, 1 ♀, Entebbe, Uganda, April 1903.

Apparently nearest to *P. striata* Butler.

16. **Euphaedra paradoxa** spec. nov.

♀. Dull red-brown with glossy greenish black margin.

Upperside.——Forewing glossy greenish black with a narrow dirty white oblique subapical bar extending from subcostal nervule to near distal margin half-way between third radial and first median nervules. Starting from inner margin from base to near posterior angle is a patch of dull red-brown with a slight green tint running up to and invading base of cell and angle between median nervure and second median nervule.——Hindwing : the same dull red-brown colour, with a narrow uniform distal margin of glossy greenish black, bearing internervular spots of paler green.

Underside : a dull pale olive-green, paler toward margins.——Forewing :

costa buff-coloured at base and again toward apex. Subapical bar white.——Hindwing: basal and middle portions darker green, considerably paler in discal area. A row of very faint greenish submarginal spots in internervular spaces of distal margin. Inner margin and internal and submedian nervures covered with buff-coloured hairs. Fringe blackish, dotted with white, especially at apex of forewing.

Expanse: 62 mm.

1 ♀, Ugaia, South Kavirondo, January 1903.

This remarkable little species resembles to some extent *E. eleus* Drury as regards its upperside, while its underside seems to bring it nearer forms like *E. uganda* Auriv.

17. **Diestogyna hobleyi** spec. nov.

Dusky olive-brown with yellow markings.

Upperside.——Forewing dusky olive-brown, shaded with black scales. Crossing middle of discoidal cell a pair of black streaks outlined in yellow; at extremity of cell a similar pair. Beyond extremity of cell an oblique, yellow, rather narrow bar extending from subcostal nervure to second median nervule. Nearer the apex and forming the other side of a triangle of which the costa is the base is a row of five white spots, the first above subcostal nervure, the last between third radial and first median nervules. Dark internervular streaks join the two sides of the triangle. Parallel with distal margin from a point close to apex to posterior angle is a dusky black submarginal stripe interrupted somewhat by crossing nervules near apex.——Hindwing: Base to just beyond end of cell, inner and distal margins dusky olive-brown. Dark linear shading at extremity of cell. A large patch of an ochreous buff colour fills the discal half of the wing nearer costa. A double row forming irregular dusky streaks, of which the outer is best defined, crosses the outer discal portion of the wing.

Fringe olive-brown, a white spot at apex and posterior angle of forewing, a few small white dots on distal marginal fringe, internervular on forewing, on extremity of nervules on hindwing.

Underside.——Chestnut-brown, with costa, apex, posterior angle of forewing and whole of hindwing except distal margin shaded with grey; oblique bar on forewing white. Markings of upperside where present paler. Inner margin of forewing pale olive-brown. On hindwing an irregular line crosses basal portion just beyond extremity of cell, and a row of seven small white spots crosses discal area.

Expanse: 59 mm.

1 ♀ (?) captured by Mr. Hobley at Kisumu, no data, kindly lent me for description by Mr. Roland Trimen.

A single specimen also in British Museum from the Congo, rather smaller and with subapical yellow bar smaller and less defined.

18. **Charaxes eudoxus mechowi** Rothsch.

1 ♂, Tiriki Hills, March 1903.

Upperside.——Differs from *eud. eudoxus* in all markings of both wings being

of a darker red-brown colour; in basal red-brown area of forewing being better defined and more extensive, reaching to the extremity of cell. The fulvous discal band common to both wings is much reduced in this variety on forewing, and is broken up above second median nervule into five internervular spots, each much smaller than the last. The *underside* is more sombre in colour, and chiefly distinguished by the great reduction of silvery markings so characteristic of *eudoxus*. The silver- and slate-coloured pencillings on the apex of the forewing are also extremely faint. In another specimen kindly lent me by Mr. Roland Trimen, captured at Kamwezi by Mr. Hobley, the silvery marking of the underside has entirely disappeared, and is only partly replaced by a dull slate-colour. The markings on the forewing are entirely absent. Both these specimens are rather larger and broader in the wings than the single specimen of *eud. eudoxus* in the Hope Department.

Expanse: 80 mm., as compared with 77.

LYCAENIDAE.

(Pl. I. f. 19.)

19. **Telipna nyanza** spec. nov.

Light orange-red with black borders.

♀. *Upperside.*——Forewing light orange-red with black costa, apex and distal margin, which narrows as it approaches the posterior angle. Parallel with the extremity of the cell, but beyond it and within the black apical area is an oblique row comprising three white spots, the first of which is immediately beneath costa.——Hindwing light orange-red with black distal marginal border extending half-way up the inner margin, with five white internervular spots upon it. Fringe black, with white internervular patches along distal margin.

Underside.——Forewing: ground-colour rather paler, black apex much reduced. In black costal and apical border, extending from costa to the juncture of apex and distal margin, are twelve silvery white spots. The row of three spots visible on the upperside is well marked, and between the middle of the three spots and apex is an additional white spot. Black distal marginal border almost linear.——Hindwing: ground-colour as on forewing. Upon costa above extremity of cell a black streak with a white streak on either side, with a smaller black streak nearer the base. Distal margin black dotted with two rows of internervular silvery white spots; the outer row seven in number, the inner nine. Of the inner row, the third, fourth and fifth spots lie between the black margin and the orange-yellow ground-colour. The spots of the outer row somewhat triangular in shape. Fringe as on upperside.

Expanse: 53 mm.

1 ♀ from Entebbe, April 10th, 1903.

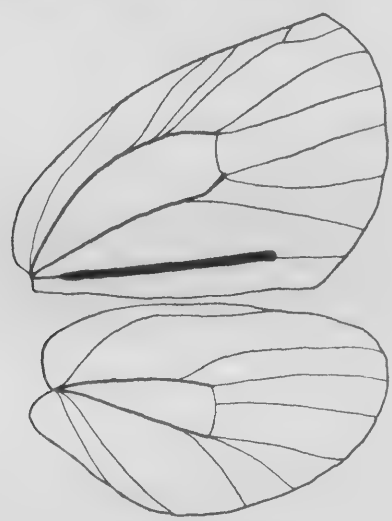
Allied to *T. acraea* Dbl. and Hew., from which it differs in the smaller size of the white bar, and much greater extent of the orange-red areas on both upper- and undersides.

Poultonia gen. nov.

Head short and broad; eyes smooth; palpi very short, slightly convergent at tips. Antennae short, about one-third the length of costal margin, with gradually formed club. Thorax robust, almost Hesperiad in appearance. Wings short and broad. Closing discocellular nervule scarcely visible, especially on upperside, producing appearance of open cell. Well-marked brand in ♂ on submedian nervure from base for two-thirds of its length.

Forelegs well developed and smooth.

Allied to *Durbania* Trim. in shape of wings, and to *Teriomima* Kirby in coloration. Differs from both in venation.



Neuration of *Poultonia*.

Type: *P. ochrascens* spec. nov.

The species figured by H. Grose-Smith as *Durbania barca*, Rhop. Exotica iii. t. 27. f. 3. 4 (1891) from South Africa, also evidently belongs to this genus.

I have much pleasure in dedicating this genus to Professor E. B. Poulton, D.Sc., F.R.S., of the Hope Department, Oxford University Museum.

20. **Poultonia ochrascens** spec. nov. (Pl. I. f. 13).

♂ ♀. Ochreous with black border.

Upperside.——Forewing: ochreous yellow. Costa ochreous at base; narrow black costal margin widening at apex and narrowing gradually as it follows distal margin to posterior angle, where it ceases. Border on distal margin slightly inwardly denticulate at nervules. An elongate ochreous band on submedian nervure from base for two-thirds of its length.——Hindwing: ochreous, with black distal marginal border, broadest at apex, narrowing as it approaches anal angle. The discal row of pale spots of underside faintly visible.

Underside.——Forewing: black margins of upperside replaced by brownish grey, and nervures outlined in same colour. Costal margin broad throughout, from base scattered with seven or eight small pale, rather indefinite, spots.——Hindwing uniformly brownish grey with a few whitish spots. Of these the

most marked are one above cell near base, two within cell, one near middle and the other near extremity. Two similar spots situated below cell. A discal row semicircular in shape of eight better defined spots from costa to submedian nervure, the last being slightly out of line.

Fringe greyish, especially marked on upperside. Palpi ochreous; thorax ochreous above, black with ochreous spots beneath; abdomen ochreous throughout.

Expanse, 35 mm.

1 ♂, Usemi, May 1—7, 1903.

Mr. Wiggins has subsequently sent 2 ♂♂, 1 ♀, of this species from Kisumu, August 1—15, 1903. The ♀ differs from the ♂ in its slightly larger size, paler colour, and absence of brand.

Evidently allied to *Poultonia barca* Grose-Smith, *l.c.*, from which it differs in the narrower and better defined black borders of upperside and in greyer colour and presence of pale spots on underside.

21. **Mimacraea poultoni** spec. nov. (Pl. I. f. 18.)

♂. Brownish black with orange-red markings.

Upperside.——Forewing brownish black. An oblique narrow bar crosses subapical portion of wing. It is yellow in colour, faintly outlined with orange, and divided into five or six portions by intersecting nervules. Starting from subcostal nervure, it nearly reaches third radial nervule. Starting from inner margin is a broad orange area running up as far as third radial nervule, narrowing somewhat as it approaches it.——Hindwing dusky black at base. A broad orange band crosses middle portion of wing from costa to inner margin, just including extremity of cell. This band varies from pale yellow to orange in colour, except at its costal end. In one specimen this band is markedly broader and the orange colour extends along nervules into the distal marginal border. A broad black distal marginal band, with a rather irregular inner edge.

Underside.——Forewing: costa dusted with yellowish scales. Orange-red colour generally extends up to subcostal nervure, but three black spots remain in cell, one at its extremity and one near base below median nervure. The spotting is, however, extremely variable. The black apex of forewing and distal margins of both wings have nervules and triangular internervular streaks dusted with yellow. Base and inner margin of hindwing are dusky yellow covered with a variable number of spots. There are generally three spots below costa, two within cell and one at its extremity, and a triangular patch of three spots below median nervules. There may also be small spots in the internervular spaces around the extremity of the cell. The median band is narrower than on upperside, and is of a buff yellow colour.

Expanse, 54 mm.

2 ♂♂, Nyangori, March 1903.

1 ♂, Entebbe, April 1903.

This beautiful Acraeine mimic is evidently allied to *M. krausi* Dewitz, from which it differs in the distribution of the orange-red colour especially on the forewing. I have much pleasure in dedicating it to Professor Poulton.

22. **Aphneus drucei** spec. nov. (Pl. I. f. 6.)

♂. Fuscous, with basal area of both wings glossy blue. White subapical spots in forewing.

Allied to *A. hutchinsoni* Trim.

Upperside.——Forewing : blue area occupies base of wing, cell for two-thirds of its length, and whole of area between second median nervule and inner margin, with the exception of a moderate border near the posterior angle. At extremity of cell a fair-sized *circular* white spot. There is a subapical and submarginal row of five white spots, of which the third is considerably and fourth slightly out of line and nearer the distal margin. Costa from base to about extremity of cell broadly ferruginous. A well-marked stripe of the same colour accompanies distal margin, interrupted by fuscous nervules. Actual margin black and linear, with a black and white fringe.——Hindwing: blue occupies cellular and discal area of wing. Costal margin fuscous, inner margin greyish. Distal margin as on forewing, ferruginous colour widening at anal angle with trace of orange spots. Anal angle apparently bears two tails, the outer smaller and black, the larger and inner one ferruginous at base, but anal angle is wanting in one wing and damaged in the other.

Underside of a buff-brown colour covered with silver spots outlined in dark ferruginous.——Forewing has the following silver spots and markings : Touching costal border, a small oval one at base above subcostal nervure, two elongated spots, one crossing middle of cell to median nervure, another broader one at extremity of cell, and a shorter one nearly halfway between last mentioned and apex. Near apex, but not touching costa, two much smaller confluent spots. A small spot within discoidal cell at its base. Three somewhat confluent hindmarginal spots coincident with but larger than the three lowest spots of the row on the upperside. Upon inner margin a rather indefinite large spot somewhat triangular in shape, its apex just reaching second median nervule and not at all confluent with the markings above it.——Hindwing with the following silver spots : at base within precostal nervure a rather small semicircular spot ; between costal and subcostal nervures a fair-sized rather oval spot ; within cell at base a very small circular spot. Upon inner margin a small elongate spot. At extremity of cell a large and irregularly circular spot, a very small one below it, and a large irregular one touching costal margin above it. Beyond and around extremity of cell an irregular row of five spots, the first two very small, the third composed of three confluent spots of which the middle one is largest; the fourth considerably out of line and nearer anal angle, the fifth elongated and irregular in shape, touching inner margin. Below this last another irregular elongated streak. At junction of inner margin and anal angle a ferruginous streak outlined near margin with orange. Distal margins of both wings narrowly edged with black, with a black and white fringe.

Expanse, 34 mm.

One damaged ♂ from Mwanza, Unyamwezi, German E. Africa.

The main points of difference between this species and *A. hutchinsoni* Trim. are the ferruginous costa and distal marginal markings on upperside and the absence of a ferruginous streak following distal margin on underside. Also

the general reduction in size and somewhat different arrangement of spots on underside.

I have much pleasure in dedicating this species to Mr. H. H. Druce, who has been kind enough to give me his opinion upon it.

23. **Lycaenesthes hobleyi** spec. nov.

♂. *Upperside:* dull glossy purple. Black margins. Fringe buff-coloured. At anal angle of hindwing trace of two black eye-spots.

Underside: pale grey brown with transverse striae of the same colour, red-edged on both sides, narrowly edged again with paler brown; all striae rather narrow.——Forewing: a terminal discocellular stria. A discal stria from subcostal nervure to submedian nervure, broken at second median nervule into two very unequal portions, the lower one being markedly nearer the base of the wing. A narrow submarginal streak of a slightly darker brown than ground-colour follows course of distal margin. Base of costa and distal margin very narrowly orange-red.——Hindwing: terminal discocellular, and discal striae as on forewing. Discal stria reaches to inner margin. A subcostal red spot faintly outlined with a paler brown than ground-colour above cell near middle. A similar spot within cell upon median nervure. A smaller red spot on inner margin near base. Dark submarginal streak and narrow orange-red line on distal margin as on forewing.

At anal angle two eye-spots, inwardly red, outwardly black, dotted with glistening blue scales. Two short brownish tails.

Expanse, 27 mm.

2 ♂♂, no locality, but presumably east or north-east of Victoria Nyanza; collected by Mr. Hobley and lent me by Mr. Roland Trimen.

Apparently not very nearly allied to any known species, but resembles *L. ligures* Hew. in distribution of markings.

24. **Catochrysops nandensis** spec. nov. (Pl. I. f. 12).

♂. *Upperside:* dusky brown with glossy blue shading. On distal margin of forewing five eye-spots. All these rather indefinite except one between first and second median nervules which is black inwardly marked with bright orange. A trace of orange on spot immediately above it. Fringe white with patches of dusky brown at extremity of nervules.

Underside: pale brown with slightly darker transverse striae clearly edged with white on both sides.——Forewing: a terminal discocellular stria. A row of six discal striae from subcostal to submedian nervure. Between discal row and distal margin two parallel rows of seven white marks the shape of arrow-heads internervular in position. Distal marginal border linear and a slightly darker brown than ground-colour, inwardly accompanied by seven narrow internervular white streaks.——Hindwing has terminal discocellular and discal striae as in forewing, the latter more irregular in shape. The following black spots surrounded by clear white rings: two beneath costa; one within cell about middle, touching median nervure; two on inner margin. Other markings as

on forewing, except that the two rows of arrow-shaped white markings are somewhat confused together, and the fourth, fifth and sixth of the inner row are specially large. A well-marked orange spot between first and second median nervules, with a black pupil placed distally, the pupil partially outlined with glistening blue scales. A trace of orange colour at anal angle. Fringe as on upperside, except dusky brown patches more pronounced. Abdomen dusky black above, paler beneath, with trace of orange at apex.

Expanse, 27 mm.

1 ♂, Nyangori, March 26th, 1903.

Allied to *C. malathana* Boisd. = *asopus* Hopff. Differs in blue sheen on upperside and in distinctness and distribution of markings on underside.

25. **Castalius usemia** spec. nov. (Pl. I. f. 11).

♂♀. White with black margin.

Upperside.——Forewing white. A wide basal black suffusion well defined externally. Costa and distal margin and outer part of discal area suffused with black. At extremity of cell a denticulate black projection from costal margin invades white area. Black outer discal area and apical border isolate a somewhat elongated white spot, smaller than in *C. gregori* Butler. Smaller white spots may be present both above and below this spot. Fused discal and distal marginal black border is broader below first median nervule than above it.——Hindwing black at base, with external edge of black suffusion exactly coinciding with that of forewing, thus differing markedly from *C. gregori.* Discal and distal marginal black fused, projecting inwardly along costa at apex, inclosing traces of white dots toward discal area. On distal margin, especially at anal angle, a narrow interrupted white line. Small black tail tipped with white at second median nervule. Fringe of both wings grey.

Underside.——Forewing: black markings broken up into streaks and dots. Across base a black streak from costa before middle, and parallel and close to it a similar shorter streak starting from about middle of interior of cell; This latter streak is sometimes continuous with, but generally separated from, a short transverse marking in the shape of a triangle with its base on the costa and its apex at the origin of the third radial nervule. Between these two points the marking crosses the apex of the cell. An irregular but well-marked discal transverse streak, emitting a well-marked projection outward between radial nervules, interrupted at first median nervule and continuing to inner margin nearer base of wing. A submarginal black streak becoming fused with discal streak about first median nervule. A distal marginal row of six small black spots bounded by a black edging line.——Hindwing: two short black streaks across base; outermost and longest coinciding with outer one of forewing. Discal stripe widely interrupted between second subcostal and radial nervules. Submarginal stripe somewhat irregular, and becoming fused with discal at third radial nervule. Six spots with a black margin as in forewing, but four spots nearest anal angle outlined in glistening blue; on inner margin, a little beyond middle, a small black rectangular spot.

Abdomen striped black and white above, white below.

Expanse, 26 mm.

Ugaia, 2 ♂♂; Nyangori, November 1—8, 1 ♂; Usemi, May 1—7, 1 ♂ 2 ♀♀. The *females* are of a more transparent white colour than the *males*.

Evidently allied to *C. calice* Hopff. and *C. gregori* Butler, but differs in the distribution of black markings on both sides, especially at base of wings.

PIERIDAE.

26. **Mylothris tirikensis** spec. nov. (Pl. I. f. 9).

Apparently allied to *M. rueppelli* Koch.

♀. *Upperside.*——Forewing: ground-colour white, base of wing nearly to extremity of cell and extending slightly along inner margin, ochreous red, heavily dusted especially in region of cell with dark scales. Costal edge black and linear, widening considerably at apex, and following distal margin breaks up into two spots at extremities of first and second median nervules. One small spot at extremity of submedian nervure.——Hindwing pale sulphur-yellow at base, slightly dusted with dark brown scales. On distal margin six small black spots at ends of nervules.

Underside.——Silvery white. Base of forewing nearly to extremity of cell and base of costa of hindwing bright orange. At apex and distal margin of forewing at end of nervules seven, on hindwing six small black spots.

Expanse, 43 mm.

This peculiar little species, of which we have a single ♀ from the Tiriki Hills, 26. ii. 03, is probably nearest to *M. rueppelli* Koch, from which it differs in the much smaller size, in the dusting over of the base of both wings with dark scales, giving it a very different appearance, and in the relatively heavier black marking of apex of forewing.

27. **Pinacopteryx dixeyi** spec. nov. (Pl. I. f. 10).

White, with black margins and spots.

♂. *Upperside.*——Forewing creamy white. Costal edge black and linear, widening at apex, narrowing as it follows distal margin, ending in two small spots at extremities of second median nervule and submedian nervure.——Hindwing as forewing, with seven circular black spots on distal margin at end of nervules, with a small additional one between those on second median nervule and submedian nervure.

Underside.——Base of both wings and costa of hindwing, especially at base, flushed with orange. At apex and distal margin of forewing seven black spots, becoming smaller toward anal angle. Faint subapical yellow streaks between nervules of both wings.

♀ differs in slightly larger size—51 mm. nearly. Base and costa of forewing dusky. Apex and distal margin of forewing broader but less black, interrupted by rather ill-defined yellow internervular streaks. Both wings less heavily scaled and more transparent.

Expanse, 49 mm.

5 ♂♂, 6 ♀♀, from Toro.

Allied to *P. charina* Boisd., from which it differs in its white colour and less heavy but better defined markings.

I have great pleasure in dedicating this species to Dr. F. A. Dixey, of Wadham College, Oxford.

PAPILIONIDAE.

28. **Papilio gallienus peculiaris** subsp. nov. (Pl. I. f. 7).

♀. Dusky brown, with scanty cream-coloured markings.

Upperside.——Forewing dusky brown, base and costal margin rather darker in colour than distal margin and rest of wing. A small whitish spot on apical margin. At the upper part of extremity of cell, a small indefinite cream-coloured patch on each side of subcostal nervure, lying both within and without cell. Beyond extremity of cell a narrow pale cream-coloured stripe extending from the first to the third radial nervule. Below the first median nervule begins a broad band of the same colour, becoming rather heavily dusted with brown scales as it reaches the distal margin. The inner part of this band is extended on to the hindwing as far as the cell.——The hindwing has a dark brown base of a triangular shape; the rest of wing paler brown, of a slightly redder tint than the forewing, becoming dark again at the distal margin; three dark streaks within the cell, and well-marked internervular streaks extending from the cell to the distal margin.

Underside paler in colour, with the cream-coloured markings better defined. Dark internervular streaks on the forewing, especially towards the apex. At the base of the hindwing a small orange triangular patch with one black spot upon the precostal nervure and a large one above the base of the cell. Fringe dark brown, with small white internervular patches on the hindmargin of the hindwing. This margin is slightly serrated.

Expanse, 82·5 mm.

1 ♀ from Entebbe, Uganda, April 6th, 1903.

Probably allied to *P. cynorta* Fabr.

29. **Papilio gallienus whitnalli** subsp. nov.

♂♀. Dusky brown with pale sulphur-yellow markings.

The eastern form of *gallienus*, somewhat resembling *P. cypraeofila* Butler.

Upperside dusky brown. A pale sulphur yellow stripe crosses both wings, in the forewing commencing near the costa, about midway between apex and extremity of cell, breaking up into nine somewhat elongated spots, of which the last is least well defined and the next above it, which is placed between the submedian nervure and second median nervule, is broader and less elongated. The stripe crossing hindwing is complete. It includes extremity of cell, and is invaded outwardly by short internervular projections of the ground colour. There is a small yellow spot upon apex of forewing, and five small spots of

the same colour upon hindmargin, slightly increasing in size as they approach the posterior angle. There are seven larger internervular spots upon distal margin of hindwing.

Underside.——Forewing paler brown and rather redder brown at apex. There may be a small rather ill-defined spot at lower part of extremity of cell.——Hindwing: base ochreous-orange colour with black markings reaching nearly to extremity of cell, where it is bounded by a creamy white stripe crossing the wing. Within this basal area one well-marked black streak between costa and subcostal nervure; one short one between first subcostal nervule and subcostal nervure; three within the cell; a trace of one between median nervure and second median nervule (this may be absent); one on each side of internal nervure. The rest of wing brown with darker brown internervular streaks projecting into the pale stripes and ending at the marginal spots, which are the same as on upperside. The creamy yellow colour of stripe may invade this brown area somewhat between the radial and second subcostal nervules.

♀ differs in slightly larger size, and in the better development of the spot at extremity of cell on forewing, which may be visible on upperside.

It will be seen that this subspecies is intermediate between *P. cypraeofila* Butler and *P. gallienus* Dist. In the macular nature of the spots of the forewing it differs from *P. cypraeofila*, while in width of stripe in hindwing and extent of ochreous-orange basal area it is intermediate between the two species. The hindwing seems to be more markedly denticulated and the angle in the middle of distal margin more produced toward a tail than in *P. g. gallienus.*

3 ♂♂, 3 ♀♀, Entebbe, April 1—12, 1903.

Expanse: ♂, 102 mm.; ♀, 105 mm.

I have much pleasure in dedicating this form to my friend Mr. S. Ernest Whitnall, of Magdalen College, Oxford.

HESPERIIDAE.

30. **Cyclopides trisignatus** spec. nov. (Pl. I. f. 8).

♂. Dusky brown with golden yellow spots.

Upperside, both wings dusky brown. On forewing three golden yellow spots arranged in a triangle in the distal third of the wing. The smallest spot which forms the apex of the triangle is nearest the distal margin.

On hindwing four small golden yellow spots, of which the largest is near the apex. A few golden yellow scales scattered around the extremity of the cell.

Underside.——Forewing as upperside. Hindwing uniformly dusky brown.

Expanse: 28 mm.

1 ♂, Entebbe, April 4, 1903.

Allied to *C. quadrisignatus* Butler, but differs in arrangement of spots in both wings.

	Ugaia Jan. 1–31, 1903.		Kalachonyo Plain Dec. 19–27, 1902.		Kisumu I. 25. 11. 02 –7. 2. 03.		Kisumu II. 8. 3. 03 –10. 5. 03.	
NYMPHALIDAE.								
Danainae.								
Limnas chrysippus f. *chrysippus* Linn. .	4♂	7♀	2♂	—	47♂	21♀	7♂	—
„ „ f. *alcippoides* Moore .	—	—	—	—	13♂	2♀	—	—
„ „ f. *alcippus* Cram. .	1♂	—	—	—	6♂	2♀	—	—
„ „ f. *dorippus* Klug .	2♂	1♀	1♂	—	69♂	28♀	5♂	1♀
„ „ f. *albinus* Lanz . .	—	—	—	—	6♂	4♀	1♂	—
Tirumala limniace petiverana Dbl. & Hew.	1♂	—	—	—	—	—	—	—
Melinda mercedonia Karsch . . .	—	—	—	—	—	—	—	—
„ *formosa formosa* Godm. . .	1♂	—	—	—	—	—	—	—
Amauris niavius niavius Linn. . . .	—	—	—	—	—	—	—	—
„ „ f. intermediate to *dominicanus* Trim. . .	—	—	—	—	—	—	—	—
„ *psyttalea psyttalea* Plötz . .	5♂	—	1♂	—	—	—	—	—
„ *damoclides* Staud. . . .	—	—	—	—	—	—	—	—
„ *dira* spec. nov.	—	—	—	—	—	—	—	—
„ *hecate* Butler	—	—	—	—	—	—	—	—
„ *echeria jacksoni* Sharpe . .	—	—	—	—	—	—	—	—
„ *albimaculata* Butler . . .	—	—	—	—	—	—	—	—
Elymniinae.								
Elymnias phegea Fabr.	—	—	—	—	—	—	—	—
„ *bammakoo* Westw. . . .	—	—	—	—	—	—	—	—
Satyrinae.								
Melanitis leda Linn. . . .	1		—	—	—	—	2	
„ *libya* Dist.	—		—	—	—	—	—	
Gnophodes parmeno Dbl. & Hew. . .	2		—	—	—	—	—	
„ *chelys* Fabr.	—		—	—	—	—	—	
Bicyclus iccius Hew.	—		—	—	—	—	—	
Mycalesis dentata Sharpe	2		—	—	—	—	—	
„ *mandanes* Hew. . . .	4		—	—	—	—	—	
„ *technatis* Hew. ? . . .	—		—	—	—	—	—	
„ *sophrosyne* Plotz . . .	—		—	—	—	—	—	
„ *golo* Auriv. . . .	—		—	—	—	—	—	
„ *safitza safitza* Hew. . . .	8		—	—	1		6	
„ *martius* Fabr.	—		—	—	—		—	
„ *vulgaris* Butler . . .	7		—	—	2		—	
„ *nebulosa* Feld.	—		—	—	—		—	
„ *matuta* Karsch	—		—	—	—		—	
„ *saussurei* Dewitz . . .	20		—	—	—		—	
„ *ansorgei* Sharpe . . .	—		—	—	—		—	
Henotesia perspicua f. *perspicua* Trim. .	4		—	—	3		1	
Neocoenyra gregori Butler . . .	1		—	—	—		—	
Ypthima asterope Klug	—		1		—		—	
„ *impura* E. & E.	1		—		—		—	
„ *albida* Butler	—		—		—		—	

Nyangori I. 1. 11. 02 -5. 12. 02.		Nyangori II. 27. 1. 03.		Nyangori III. 25. 3. 03 -26. 4. 03.		Tiriki Hills 20. 2. 03 -20. 3. 03.		Usemi May 1903.		Entebbe April 1-12, 1903.		Toro Nov.-Dec. 1900.	
9 ♂	3 ♀	—	—	4 ♂	5 ♀	2 ♂	4 ♀	3 ♂	2 ♀	4 ♂	7 ♀	5 ♂	—
—	—	—	—	—	—	—	—	—	1 ♀	—	—	—	—
2 ♂	—	—	—	—	3 ♀	2 ♂	—	—	—	1 ♂	1 ♂	—	—
4 ♂	1 ♀	—	—	4 ♂	2 ♀	3 ♂	1 ♀	4 ♂	2 ♀	18 ♂	17 ♀	1 ♂	—
2 ♂	—	—	—	—	—	—	—	—	—	—	—	—	—
12 ♂	3 ♀	—	—	5 ♂	1 ♀	—	—	—	—	1 ♂	—	29 ♂	14 ♀
—	—	—	—	—	—	—	—	—	—	1 ♂	—	29 ♂	—
9 ♂	2 ♀	—	—	4 ♂	—	24 ♂	2 ♀	—	—	—	—	—	—
1 ♂	—	—	—	1 ♂	—	1 ♂	—	—	—	15 ♂	12 ♀	79 ♂	17 ♀
1 ♂	—	—	—	—	—	—	—	—	—	1 ♂	—	—	—
4 ♂	1 ♀	—	—	1 ♂	—	14 ♂	4 ♀	—	—	3 ♂	2 ♀	3 ♂	—
16 ♂	5 ♀	—	—	3 ♂	1 ♀	—	—	—	—	3 ♂	—	13 ♂	2 ♀
1 ♂	—	—	—	—	—	1 ♂	—	—	—	—	—	—	—
1 ♂	—	—	—	—	—	1 ♂	—	—	—	—	—	2 ♂	—
17 ♂	2 ♀	—	—	12 ♂	4 ♀	14 ♂	2 ♀	—	—	3 ♂	—	8 ♂	—
3 ♂	—	—	—	3 ♂	1 ♀	9 ♂	5 ♀	—	—	1 ♂	3 ♀	18 ♂	4 ♀
—	—	—	—	—	—	—	—	—	—	—	—	1 ♂	1 ♀
—	—	—	—	—	—	—	—	—	—	3		3 ♂	1 ♀
1		—	—	2		1		4		26		—	—
—		—	—	—		1		—		—		—	—
—		—	—	—		6 ♂	3 ♀	—		9 ♂	3 ♀	—	—
—		—	—	—		14 ♂	3 ♀	—		1 ♂	—	—	1 ♀
—		—	—	—		—	—	—		4		—	—
1		—	—	—		14		—		—		2	
—		—	—	—		15		—		19		1	
—		—	—	—		—	—	—		3		—	
—		—	—	—		—	—	—		4 ♂	—	—	
1 ♂	—	—	—	—		7 ♂	3 ♀	—		6 ♂	—	—	
6		1		3		1		4		8		3	
—		—		—		1		—		2		3	
5		—		1		2		—		18		—	
—		—		—		—	2 ♀	—		45 ♂	15 ♀	5 ♂	—
—		—		—		—	—	—		—	—	1	
—		—		—		1		—		—	—	3	
—		—		—		—		—		5 ♂	2 ♀	2 ♂	1 ♀
—		—		—		—		10		4		—	
27		—		12		3		—		—		2	
—		—		—		—		—		11		2	
2		—		—		—		—		—		2	
23		—		1		3		—		9		2	

	UGAIA Jan. 1–31, 1903.	KALACHONYO PLAIN Dec. 19–27, 1902.	KISUMU I. 25. 11. 02 –7. 2. 03.	KISUMU II. 8. 3. 03 –10. 5. 03.
NYMPHALIDAE—continued				
Acraeinae.				
Pardopsis punctatissima Boisd. .	—	1	73	15
Acraea quirinalis Grose-Smith . . .	—	—	—	—
„ *iturina* Grose-Smith . . .	—	—	—	—
„ *humilis* Sharpe	—	—	—	—
„ *cinerea* spec. nov.	—	—	—	—
„ *insignis* Dist.	1♂ 2♀	—	—	—
„ *neobule* Dbl. & Hew. . . .	— —	—	52♂ 28♀	8♂ 2♀
„ *asboloplintha* Karsch. . . .	— —	—	— —	— —
„ *zetes* Linn.	— —	—	— —	— —
„ *egina* Cram.	2♂ —	—	— —	— —
„ *perenna* Dbl. & Hew. . . .	6	—	— —	— —
„ *wigginsi* spec. nov. . . .	—	—	— —	— —
„ *caldarena* Hew.	—	—	4♂ 3♀	— —
„ *sykesi* Sharpe	—	—	— —	— —
„ *doubledayi equatorialis* subsp. nov.	—	—	66♂ 44♀	39♂ 23♀
„ *mystica* spec. nov.	—	—	1♂ —	— —
„ *caecilia* Fabr.	—	—	3♂ —	— 2♀
„ *clarei* spec. nov.	—	—	— —	— —
„ *serena* Fabr.	3	2	88	387
„ *vinidia* f. *vinidia* Hew. . . .	3	—	1	2
„ *sotikensis* Sharpe	2	—	1	—
„ *praeponina* Staud. ? . . .	—	—	5	—
„ *bonasia* Fabr.	—	—	—	—
„ *alicia* Sharpe	1♂ —	—	6♂ 2♀	52♂ 1♀
„ *uvui* Grose-Smith	— —	—	—	— —
„ *apecida* Oberth.	— —	—	—	— —
„ *cabira* f. *cabira* Hopff. . . .	— —	—	—	— —
„ *althoffi* Dewitz.	— —	—	—	— —
„ *pharsalus* f. *pharsalus* Ward . .	1♂ —	—	—	— —
„ *encedon* f. *encedon* L. . . .	12	—	41	26
„ „ f. *alcippina* Auriv. . .	—	—	2	1
„ „ f. *lycia* Fabr. . . .	3	—	7	6
„ „ f. *daira* Godm. & Salv. .	—	—	28	18
„ *pentapolis* Ward	—	—	—	—
„ *crina* f. *orinata* Oberth. . .	—	—	—	—
„ *pomponia* Grose-Smith . . .	1	—	—	—
„ *pomponia* ?	—	—	—	—
„ *peneleos* Ward	—	—	—	—
„ *pelasgius* Grose-Smith . . .	—	—	—	—
„ *servona* Godm.	—	—	—	—
„ *semivitrea pervia* Sharpe . .	—	—	—	—
„ *circeis ntebiae* Sharpe . . .	—	—	—	—
„ *oreas* Sharpe	—	—	—	—
„ „ f. *albimaculata* nov. . .	—	—	—	—
„ *toruna* Grose-Smith . . .	—	—	—	—
„ *johnstoni* f. *flavescens* Oberth. .	—	—	—	—

Nyangori I. 1. 11. 02 -5. 12. 02.	Nyangori II. 27. 1. 06.	Nyangori III. 25. 3. 03 -26. 4. 03.	Tiriki Hills 20. 2. 03 -20. 3. 38.	Usemi May 1903.	Entebbe April 1-12, 1903.	Toro Nov.-Dec. 1900.
—	—	—	—	61	—	—
—	—	—	7	—	1	—
—	—	—	10	—	—	—
—	—	—	4 ♂ 1 ♀	—	1 ♂ 1 ♀	—
—	—	—	5 ♂ 1 ♀	—	— —	—
— 1 ♀	—	—	1 ♂ —	—	4 ♂ 7 ♀	—
— —	—	—	— —	— 1 ♀	2 ♂ —	—
— —	—	—	15	— —	— —	—
— —	—	—	—	— —	3 ♂ 4 ♀	—
6 ♂ 1 ♀	1 ♂ —	— 1 ♀	8 ♂ 2 ♀	— —	— —	—
14	— —	9	8	— —	1	4
—	— —	—	— 1 ♀	— —	—	—
—	— —	—	— —	— —	—	—
—	— —	—	— —	— —	— 1 ♀	—
—	— —	—	1 ♂ —	— —	— —	—
—	— —	—	— —	— —	— —	—
1 ♂ —	— —	— 1 ♀	1 ♂ —	— —	2 ♂ 2 ♀	—
— —	— —	— —	— —	— —	— —	—
2	— —	14	1	582	218	6
19	1	68	—	1004	82	6
4	—	8	19	—	—	1
2	1	—	— —	—	2	—
—	—	—	— —	—	—	1
20 ♂ —	17 ♂ —	—	24 ♂ 2 ♀	1 ♂ —	16 ♂ 1 ♀	4
1	— —	—	3	— —	— —	1
1	— —	54	—	— —	— —	—
—	— —	—	—	— —	20	1
—	— —	—	—	— —	1 ♂ —	—
—	— —	—	3 ♂ —	— —	4 ♂ 1 ♀	—
1	— —	2	9	10	82	1
—	— —	—	4	1	—	—
—	— —	—	1	1	108	—
—	— —	—	—	6	72	—
—	— —	—	—	—	2 ♂ 1 ♀	—
1 ♂ —	— —	—	—	—	5 ♂ —	—
— —	— —	2	—	—	7	29
— —	— —	—	6 ♂ 1 ♀	—	2	—
— —	— —	—	1	—	8	6
— —	— —	—	—	—	4	—
— —	— —	—	—	—	1	2
— —	— —	—	5	—	—	—
2 ♂ —	— —	1 ♂ 1 ♀	—	1 ♂ —	4 ♂ 2 ♀	—
1	— —	—	39	— —	— —	3
—	— —	—	4	— —	— —	—
—	— —	—	—	— —	— —	8
—	— —	—	9	— —	— —	—

	UGAIA Jan. 1–31, 1903.	KALACHONYO PLAIN Dec. 19–27, 1902.	KISUMU I. 25. 11. 02 –7. 2. 03.	KISUMU II. 8. 3. 03 –10. 5. 03.
NYMPHALIDAE—continued.				
Acraeinae.				
Acraea lycoa Godm.	—	—	—	—
„ *esebria* f. *esebria* Hew. . . .	—	—	—	—
„ *iodutta* Fabr.	—	—	—	—
„ ♀-f. *carmentis* Dbl. & Hew. ? .	—	—	—	—
„ *alciope* Hew.	—	—	—	—
„ *aurivillii* Staud.	—	—	—	—
„ *disjuncta** Grose-Smith . .	—	—	—	—
Planema tellus Auriv.	—	—	—	—
„ *arenaria* Sharpe	—	—	—	—
„ *poggei* Dewitz.	—	—	—	—
„ *latifasciata* Sharpe . . .	—	—	—	—
„ *paragea* Grose-Smith . . .	—	—	—	—
„ *godmani* Butler	—	—	—	—
Nymphalinae.				
Atella columbina Cram.	—	—	—	—
„ *phalantha aethiopica* R. & J. . .	4	—	3	—
Brenthis hanningtoni Elwes . . .	—	—	—	—
Antanartia schaeneia Trim. . . .	—	—	—	—
„ *abyssinica* Feld. . . .	—	—	—	—
Pyrameis cardui Linn. . . .	7	1	16	9
Vanessula milca Hew.	—	—	—	—
Precis orithya madagascariensis Guen. .	2	—	5	—
„ *clelia clelia* Cram.	11	8	42	15
„ *oenone cebrene* Trim. . . .	4	6	18	7
„ *westermanni suffusa* R. & J. . .	6♂ —	—	—	—
„ *sophia sophia* Fabr. . . .	2	1	8	10
„ „ *infracta* Butler . . .	—	—	3	3
„ *octavia sesamus* f. *natalensis* Staud.	6	—	—	—
„ „ „ f. *sesamus* Trim. .	2	—	11	1
„ *ceryne ceryne* Boisd. . . .	25	—	1	—
„ *actia* f. *actia* Dist.	1	—	2	—
„ *aurorina* Butler	1 ?	—	—	—
„ *rauana* Grose-Smith . . .	—	—	—	—
„ *coelestina* Dewitz	1	—	—	—
„ *archesia* f. *pelasgis* Godt. . .	—	—	1	1
„ *terea terea* Drury	3	—	2	4
„ *stygia gregori* Butler . . .	10	—	2	—
„ *chorimene* Guer.	16	13	37	27
„ *artaxia* Hew.	42	—	—	—
Catacroptera cloanthe cloanthe Cram. .	19	3	12	5
Salamis parhassus aethiops Palis. . .	—	—	—	—
„ *temora* Feld.	—	—	—	—
Hypolimnas misippus f. *misippus* Linn. .	5♂ 1♀	10♂ 4♀	18♂ 39♀	12♂ 3♀
„ „ ♀-f. *alcippoides* Butler	— —	— —	7	— —

* *Acraea unimaculata* Grose-Smith, 1♂, from Kakamegas near

Nyangori I. 1. 11. 02 -5. 12. 02.		Nyangori II. 27. 1. 03.		Nyangori III. 25. 3. 03 -26. 4. 03.		Tiriki Hills 20. 2. 03 -20. 3. 03.		Usemi May 1903.		Entebbe April 1–13, 1903.		Toro Nov.–Dec. 1900.	
—		—	—	—		5♂	3♀	—	—	22♂	11♀	8♂	1♀
5♂	1♀	—	—	2♂	—	—	—	—	—	—	—	—	—
1♂	—	—	—	—	—	6		—	—	9		—	—
—	—	—	—	—	—	—	1♀	—	—	—	1♀	—	—
—	—	—	—	—	—	—	—	—	—	23♂	—	1♂	—
—	—	—	—	—	—	—	—	—	—	14♂	—	—	
1		—	—	—	—	24		—	—	—	—	—	
1♂	—	—	—	—	—	1♂	—	—	—	2♂	4♀	—	
—	—	—	—	—	—	—	—	—	—	1♂	8♀	—	
—	—	—	—	1♂	—	3♂	1♀	—	—	—	—	3♂	—
—	—	—	—	—	—	11♂	12♀	—	—	—	—	1♂	—
—	—	—	—	—	—	—	—	—	—	1♂	1♀	—	—
—	—	—	—	—	—	—	—	—	—	—	2♀	—	—
—	—	—	—	—	—	—	—	—	—	8		—	—
16		2		11		23		2		18		65	
1		—		—		1		—		—		—	
—		—		—		3		—		—		—	
—		—		—		—		—		—		3	
—		2		—		—		4		1		1	
—		—		1		34		—		—		4	
—		—		—		—		—		—		—	
4		—		10		2		58		16		11	
—		—		—		—		6		—		—	
20♂	1♀	1♂	—	17♂	1♀	12♂	2♀	—		—		38♂	—
15		4		16		—		—		22		7	
16		1		34		—		2		—		—	
1		—		—		1		1		—		—	
9		6		1		4		6		4		4	
—		—		—		—		—		1		5	
1		—		3		2		—		1		—	
—		—		—		—		—		—		1	
—		—		—		12♂ ?	—	—		—	3♀	—	
12		4		4		—	—	—		—	—	1	
11		1		13		3		—		8		4	
39		6		51		2		4		7		14	
7		—		1		41		—		1		23	
12		—		3		—		25		4		1	
—		—		—		—		—		—		—	
2		—		—		—		8		—		3	
20		1		6		91		—		—		10	
—		—		—		4		—		2		12	
—	1♀	—		—		1♂	—	3♂	2♀	7♂	5♀	10♂	—
—	—	—		—		—		—	—	—	—	—	—

Mumias, which is on the railway some 15 miles N.E. of Kisumu.

	Ugaia Jan. 1–31, 1903.	Kalachonyo Plain Dec. 19–27, 1902.	Kisumu I. 25. 11. 02 –7. 2. 03.	Kisumu II. 8. 3. 03 –10. 5. 03.
NYMPHALIDAE—continued.				
Nymphalinae.				
Hypolimnas misippus ♀-f. *inaria* Cram.	1	— —	—	— —
" " ♀-f. *dorippoides* Auriv.	—	2	31	— —
" *salmacis* Drury	—	—	6	— —
" *monteironis* Druce	—	—	—	— —
" *dinarcha* Hew.	—	—	—	— —
" *dubius dubius* Pal.	—	—	—	— —
" " *mima* Trim.	—	—	—	— —
" *anthedon anthedon* Dbl.	—	—	—	— —
Apaturopsis cleocharis Hew.	—	—	—	— —
Kallima rumia Dbl. & Hew.	—	—	—	— —
" *ansorgei* Rothsch.	—	—	—	— —
Eurytela hiarbas lita R. & J.	—	—	—	—
" *dryope angulata* Auriv.	1	1	—	—
Neptidopsis ophione ophione Cram.	—	—	—	—
" " *velleda* Mab.	1	—	—	—
Ergolis enotrea Cram.	3	—	—	—
Mesoxantha ethosea Drury	—	—	—	—
Byblia ilithyia ilithyia Drury	5	—	6	—
" *anvatara acheloia* Wallgr.	1	—	8	1
Asterope occidentalium Mab.	—	—	—	—
" *boisduvali* Wallgr.	13♂ —	—	—	—
" *ansorgei* R. & J.	1	—	—	—
Marpesia camillus Fabr.	—	—	—	—
Neptis saclava marpessa Hopff.	2	—	—	—
" *nemetes* Hew.	—	—	—	—
" *agatha* Stoll.	3	—	7	1
" *conspicua* spec. nov.	—	—	—	—
" *nicomedes nicomedes* Hew.	—	—	—	—
" *strigata* Auriv.	—	—	—	—
" *clarei* spec. nov.	—	—	—	—
" *melicerta melicerta* Drury	—	—	—	—
" *ochracea* spec. nov.	—	—	—	—
" *woodwardi* Sharpe	—	—	—	—
Pseudacraea lucretia expansa Butler	—	—	—	—
" *kuenowi neumanni* Thur.	—	—	—	—
" *hobleyi* spec. nov.	—	—	—	—
" *terra* spec. nov.	—	—	—	—
" *tirikensis* spec. nov.	—	—	—	—
" *obscura* spec. nov.	—	—	—	—
Pseudoneptis coenobita Fabr.	—	—	—	—
Catuna crithea Drury	2	—	—	—
Pseudargynnis hegemone Karsch	1♂ 1♀	—	—	—
Cynandra opis Drury	— —	—	—	—
Aterica galene galene Brown	— —	—	—	—
Leucosticha daedalus Fabr.	11	1	2	—
Euphaedra ruspina Hew.	—	—	—	—

NYANGORI I. 1. 11. 02 -5. 12. 02.	NYANGORI II. 27. 1. 03.	NYANGORI III. 25. 3. 03 -26. 4. 03.	TIRIKI HILLS 20. 2. 03 -20. 8. 03.	USEMI May 1903.	ENTEBBE April 1-12, 1903.	TORO Nov.-Dec. 1900.
— —	—	—	—	2	— —	— —
— —	—	—	—	—	— —	— —
— —	—	—	—	—	1♂ —	1
— —	—	—	—	—	1♂ 2♀	—
— —	—	—	—	—	1♂ 1♀	—
— —	—	—	—	—	1	8
— —	—	1	—	—	1	14
1	—	—	—	—	1	12
—	—	—	1	—	—	—
—	—	11	—	—	—	2♂ —
15	—	—	—	—	—	— —
1	—	—	5	—	9	9
1	-	—	—	—	9	1
—	—	—	—	—	2	—
2	—	—	3	—	1	3
10	—	4	7	—	33	15
—	—	—	—	—	—	3
—	-	—	—	—	—	4
6	—	3	—	4	27	20
1	1	2	15	—	1	—
10♂ 1♀	1♂ —	1♂ —	4	—	11♂ 3♀	—
3	— —	— —	3	—	35	1
4	1	11	35	—	11	—
4	—	1	2	—	3	—
—	—	—	—	—	1	—
8	—	2	4	10	5	7
1♂ 1♀	—	—	1	—	1♂ —	—
— —	—	—	—	—	1	—
— —	—	—	—	—	3	2
— —	—	—	—	—	1	—
— —	—	—	7	—	1	1
— —	—	—	—	—	1	—
— —	—	—	7	—	—	—
16	—	38	8	—	11	24
—	—	—	—	—	2♂ —	—
—	—	—	—	—	2♂ —	—
—	—	—	—	—	1♂ —	—
—	—	—	2♂ —	—	— —	— 1♀
—	—	—	— —	—	1♂ 1♀	— —
—	—	—	— —	—	— —	4
—	—	—	8	—	— —	2
—	—	2♂ -	12♂ 9♀	—	1♂ —	9♂ —
—	—	— —	—	—	— 3♀	1♂ —
1♂ —	—	2♂ 1♀	5♂ 4♀	—	17♂ 13♀	6♂ 10♀
4	—	2	1	3	— —	— —
—	—	—	—	—	— —	1

	Ugaia Jan. 1–31, 1903.		Kalachonyo Plain Dec. 19–27, 1902.		Kisumu I. 25. 11. 02 –7. 2. 03.		Kisumu II. 8. 3. 03 –10. 5. 03.
NYMPHALIDAE—continued.							
Nymphalinae.							
Euphaedra eleus f. *eleus* Drury . . .	—		—		—		—
„ „ f. *coprates* Druce . .	—		—		—		—
„ *paradoxa* spec. nov. . .	—	1 ♀	—		—		—
„ spec. near *medon* Linn. . .	—	—	—		—		—
„ *medon* Linn. f.? . . .	—	—	—		—		—
„ *uganda* Auriv. . . .	—	—	—		—		—
„ *losinga* Hew.	—	—	—		—		—
„ *spatiosa* Mab.	—	—	—		—		—
Euryphene mardania Fabr. . . .	—	—	—		—		—
„ *congolensis* Capronn. ? . .	—	—	—		—		—
„ *oxione* Hew. ?	—	—	—		—		—
„ *absolon* Fabr. ? . . .	—	—	—		—		—
„ *tentyris* f. *tentyris* Hew. ? . .	—	—	—		—		—
Diestogyna amaranta Karsch . . .	—	—	—		—		—
„ *ribensis* Ward . . .	—	—	—		—		—
Euryphura plantilla Hew. f. ? . . .	—	—	—		—		—
Cymothoe theobene theobene Dbl. & Hew. .	—	—	—		—		—
„ *egesta confusa* Auriv. . .	—	—	—		—		—
„ *caenis* Drury	—	—	—		—		—
„ *coccinata* Hew.	—	—	—		—		—
„ *sangaris* Hew.	—	—	—		—		—
Euptera hirundo Staud.	—	—	—		—		—
Euxanthe crossleyi ansorgei R. & J. . .	—	—	—		—		—
Charaxes brutus brutus Cram. . . .	1		—		—		—
„ *epijasius* Reiche. . . .	—		—		—		1
„ *castor* Cram.	2		—		—		—
„ *pollux* Cram.	1		—		—		—
„ *eudoxus mechowi* Rothsch. . .	—		—		—		—
„ *etesipe* Godm.	—		—		—		—
„ *lucretius* Cram.	—		—		—		—
„ *anticlea* Drury	4		—		—		—
„ *baumanni* Rogenh. . . .	1		—		—		—
„ *etheocles etheocles* Cram. . .	14 ♂	—	1 ♂	—	3 ♂		—
„ „ ♀-f. *kirki* Butler .	—	—	—	—	1 ♀		—
„ „ ♀-f. *cedreatis* Hew. .	—	—	—	—	—	—	—
„ „ *pythodoris* Hew. . .	—	—	—	—	—	—	—
„ „ *tiridates tiridates* Cram.	—	—	—	—	—	—	—
„ „ *numenes* Hew. . .	—	—	—	—	—	—	—
„ „ *candiope* Godm. . .	2		—	—	—	—	1
„ „ *varanes varanes* Cram. .	—		—	—	—	—	2
„ „ *decius* Cram. . .	—		—	—	—	—	—
„ „ *lichas* Dbl. & Hew. .	—		—	—	—	—	—
„ „ *paphianus* Ward . .	—		—	—	—	—	—
„ „ *zoolina zoolina* Dbl. & Hew. . . .	—		—	—	1		—
„ „ *neanthis* Hew. . .	—		1		4		4

Nyangori I. 1. 11. 02 –5. 12. 02.	Nyangori II. 27. 1. 03.	Nyangori III. 25. 2. 03 –26, 4. 03.	Tiriki Hills 20. 2. 03 –20. 3. 03.	Usemi May 1903.	Entebbe April 1-12, 1903.	Toro. Nov.–Dec. 1900.
—	—	—	2	—	— —	3
—	—	—	—	—	— —	1
—	—	—	—	—	— —	—
—	—	—	—	—	— —	2
—	—	—	—	—	19	—
—	—	—	7♂ 3♀	—	—	—
—	—	—	—	—	12	8
—	—	—	—	—	3	2
—	—	—	—	—	1♂ 1♀	1♂ —
—	—	—	—	—	— —	— 1♀
—	—	—	—	—	— —	4♂ 1♀
—	—	—	—	—	1♂ 2♀	4♂ 1♀
—	—	—	—	—	— —	5♂ 1♀
—	—	—	—	—	? —	— 1♀
—	—	—	3♂ 1♀	—	1♂ 1♀	— —
—	—	—	1♂ 1♀	—	— —	— —
—	—	—	— —	—	— —	24♂ 1♀
—	—	—	— —	—	— —	1♂ —
—	—	—	— —	—	— —	— 1♀
—	—	—	— —	—	— —	1♂ —
—	—	—	— —	—	— —	5♂ —
—	—	—	— —	—	1	— —
—	—	—	2♂ —	—	—	— —
3	—	—	— —	—	—	— —
1	—	—	— —	—	—	— —
18	—	3	— —	—	—	— —
33	—	25	9	—	—	— —
—	—	—	1♂ —	—	—	— —
4♂ —	—	2♂ —	1♂ —	—	2♂ —	2♂ —
— —	—	— —	— —	—	2	1
1	—	5	1	—	—	2
12	—	11	1	—	—	—
31♂ 4♀	—	22♂ 1♀	10♂ —	—	—	8♂ —
— —	—	— —	— —	—	—	— —
— —	—	— —	— 1♀	—	—	— —
3♂ —	—	— —	— —	—	—	— —
8♂ 1♀	—	6♂ 2♀	— —	—	—	5♂ —
9♂ —	—	16♂ —	3♂ —	—	—	3♂ —
36	—	25	5	—	—	— —
9	—	10	9	4	2	7
—	—	—	—	—	—	1♂ —
—	—	—	—	—	—	9
—	—	—	—	—	2	2
—	—	—	—	1	—	—
—	—	—	—	—	—	—

	Ugaia Jan. 1–31, 1903.	Kalachonyo Plain Dec. 19–27, 1902.	Kisumu I. 25. 11. 02 –7. 2. 03.	Kisumu II. 8. 3. 03 –10. 5. 03.
NYMPHALIDAE—continued.				
Nymphalinae.				
Charaxes eupale Drury, f. intermediate to *dilutus* Rothsch.	7	—	—	—
,, *zingha* Cram.	—	—	—	—
Libytheinae.				
Libythea labdaca Westw.	2	—	—	—
LEMONIIDAE.				
Abisara gerontes Fabr.	—	—	—	—
LYCAENIDAE.				
Telipna nyanza spec. nov. . . .	—	—	—	—
,, *carnuta carnuta* Hew. . . .	—	—	—	—
Pentila clarei spec. nov.	—	—	—	—
,, *petreia petreia* Hew. . . .	—	—	—	—
Poultonia ochracea spec. nov. . . .	—	—	—	—
Mimacraea poultoni spec. nov. . . .	—	—	—	—
Teriomima xantha Grose-Smith . .	—	—	—	—
Larinopoda tera Hew.	—	—	—	—
Tetraharnis ilma Hew.	—	—	—	—
? *Aslanga purpurascens* Holl. . . .	—	—	1	—
Epitola pinodoides Smith & Kirby . .	—	—	—	—
Lachnocnema bibulus Fabr.	—	—	—	— 1♀
Megalopalpus similis Kirby . . .	—	—	—	— —
Rapala coerulea Druce	—	—	1	— —
Virachola antalus Hopff.	—	—	1♂ 2♀	— —
Myrina silenus Fabr.	—	—	— —	— —
Oxylides faunus f. *albata* Auriv. . .	—	—	— —	— —
Hypolycaena hatita Hew. f. ? . . .	2♂ 1♀	—	— —	— —
,, *antifaunus* Dbl. & Hew. .	— —	—	— —	— —
,, *lebona* f. *lebona* Hew. . .	— —	—	— —	— —
,, *liara* Druce	3♂ -	—	— —	— —
,, *philippus* Fabr. . . .	— —	—	— —	— —
Aphnaeus pallene Wallen.	— —	—	1	— —
,, *hollandi* Butler	— —	—	—	— —
Spindasis natalensis Dbl. & Hew. . .	— —	—	2	1
,, sp. ?	5	—	—	—
,, *aderna* Plötz	5♂ 1♀	—	—	—
Axiocerses harpax Fabr.	20♂ 1♀	1♂ —	—	3♂ —
,, *amanga* Westw. . . .	— —	— —	—	— —
Leptomyrina lara Linn.	— —	— —	7	— —
Spalgis lemolea Druce	— —	— —	—	— —
Lycaenesthes amarah Guér. . . .	— —	— —	12	— —

Nyangori I. 1. 11. 02 -5. 12. 02.	Nyangori II. 27. 1. 03.	Nyangori III. 25. 3. 03 -26. 4. 03.	Tiriki Hills 20. 2. 03 -20. 8. 03.	Usemi May 1903.	Enterbe April 1-12, 1903.	Toro Nov.-Dec. 1900.
6	—	1	8	—	—	5
—	—	—	—	—	1	1
—	—	2	1	—	—	—
—	—	—	17	—	—	1
—	—	—	—	—	— 1 ♀	—
—	—	—	—	—	2 ♂ —	—
1 ♂ —	—	1 ♂ —	—	—	2 ♂ 1 ♀	2 ♂ —
— —	—	— —	—	—	24	— —
— —	—	— —	—	1 ♂ —	—	— —
— —	—	2 ♂ —	—	— —	1 ♂ —	— —
— —	—	— —	—	— —	4	— —
— —	—	— —	—	— —	3	— —
— —	—	— —	1	— —	—	— —
— —	—	— —	—	— —	—	— —
— —	—	— —	1	— —	—	— —
— —	—	— —	—	1 ♂ —	—	— —
— —	—	— —	—	— —	4	— —
— —	—	— —	—	— —	—	— —
— —	—	— —	—	— —	1 ♂ —	— —
— —	—	— —	—	— —	17	— —
— —	—	— —	—	— —	5 ♂ 2 ♀	2 ♂ —
38 ♂ 5 ♀	— 1 ♀	16 ♂ 4 ♀	10 ♂ 2 ♀	— —	5 ♂ —	1 ♂ —
— —	— —	— —	8 ♂ 1 ♂	— —	1 ♂ 1 ♀	3 ♂ —
— —	— —	— —	— —	— —	— —	2 ♂ —
13 ♂ 1 ♀	1 ♂ —	1 ♂ —	— —	— —	1 ♂ —	1 ♂ —
— —	— —	3 ♂ —	— —	— —	5 ♂ —	8 ♂ 1 ♀
— —	— —	1	— —	— —	— —	— —
— —	— —	—	— —	— —	— —	2
— —	— —	3	— —	1	— —	—
— —	— —	1	— —	—	— —	—
— —	— —	—	— —	—	— —	—
1 ♂ —	— —	—	— —	—	— —	—
— —	— —	—	— —	1 ♂ —	— —	—
— —	— —	—	— —	— —	— —	—
1 ♂ 2 ♀	— —	—	— —	— —	— —	—
— —	— —	—	— —	17	— —	—

	Ugaia Jan. 1–31, 1903.	Kalachonyo Plain Dec. 19–27, 1902.	Kisumu I. 25. 11. 02 –7. 2. 03.	Kisumu II. 8. 3. 03 –10. 5. 03.
LYCAENIDAE—continued.				
Lycaenesthes sylvanus Drury	— —	— —	—	— —
,, *lemnos* Hew.	4♂ 1♀	— —	1♂ 2♀	— —
,, *adherbal* Mab.	— —	— —	— —	— —
,, *ligures* Hew.	— —	— —	— —	— —
,, *larydas* Cram.	3♂ —	— —	— 5♀	— —
,, *kersteni* Gerst.	1♂ —	— —	2♂ —	— —
,, *crawshayi* Butler	1♂ —	— —	1♂ —	— —
,, sp. ?	— —	— —	— —	— —
Phylaria cyara Hew.	— —	— —	— —	— —
Uranothauma antinorii Oberth.	— —	— —	— —	— —
,, *poggei* Dewitz	— —	— —	— —	— —
,, *falkensteini* Dewitz	2	— —	— —	— —
Cacyreus lingeus Cram.	1	— —	7	— —
Castalius usemia spec. nov.	2	— —	—	— —
,, *margaritaceus* Sharpe	3	— —	—	— —
Tarucus telicanus f. *pulchra* Murray	17	— —	20	1
Azanus sigillatus Butler	3♂ —	1♂ —	1♂ 3♀	—
,, *mirza* Plotz	1♂ 1♀	— —	6♂ 1♀	—
,, *jesous* Guér.	— —	— —	3♂ 4♀	—
Polyommatus baeticus Linn.	10	— —	4	—
Cyclyrius aequatorialis Sharpe	—	— —	—	—
Catachrysops malathana Boisd.	1	— —	—	—
,, *nandensis* spec. nov.	—	— —	—	—
,, *osiris* Hopff.	—	1	1	1
,, *barkeri* Trim.	6♂ 2♀	—	1	—
,, *celaeus* Cram.	— —	— 2♀	—	—
Chilades trochilus Frey.	— —	— —	2	2
Cupidopsis hippocrates Fabr.	— —	— —	—	—
,, *cissus* Godm.	— —	— —	—	—
,, *iobates* Hopff.	5	7	3	—
Everes micyclus Cram.	—	—	—	—
Zizera antanossa Mab.	—	1	9	—
,, *gaika* Trim.	—	—	15	—
,, *lysimon* Hübn.	—	—	4	9
,, *lucida* Trim.	—	—	—	—
Oberonia punctatus Dewitz	—	—	—	—
PIERIDAE.				
Leptosia medusa Cram.	7	—	6	—
Herpaenia eriphia eriphia Godm.	7	—	—	—
Mylothris chloris Fabr.	2	—	4	—
,, *poppea* Cram.	—	—	—	—
,, *agathina* Cram.	26♂ 10♀	—	6	5
,, *rueppelli* Koch.	— —	—	—	—
,, *tirikensis* spec. nov.	— —	—	—	—
,, *yulei* Butler	4	—	—	—

Nyangori I. 1. 11. 02 –5. 12. 02.	Nyangori II. 27. 1. 03.	Nyangori III. 25. 3. 03 –26. 4. 03.	Tiriki Hills 20. 2. 03 –20. 3. 03.	Usemi May 1903.	Entebbe April 1–12, 1903.	Toro Nov.–Dec. 1900,
— —	— —	—	— —	—	— —	— 1♀
14♂ —	1♂ —	6♂ 1♀	4♂ 5♀	1♂ —	7♂ 5♀	2♂
— —	— —	1♂ —	— —	1♂ —	— —	3♂ —
— —	— —	— —	— —	— —	1♂ —	6♂ —
— —	— —	9♂ —	1♂ —	— —	— 1♀	12♂ —
— —	— —	3♂ —	— —	— —	— —	— —
— —	— —	— —	— —	— —	— —	1♂ —
— —	— —	1♂ —	— —	— —	— —	1♂ —
— —	— —	— —	42♂ 1♀	— —	— —	3♂ —
— —	— —	— —	18	— —	— —	1
— —	— —	— —	—	— —	— —	3
1	— —	6	62	1	— —	19
28	3	15	2	1	— —	14
1	—	—	—	3	— —	—
—	—	—	3	—	— —	—
37	22	85	5	19	4	17
—	—	—	—	4♂ —	—	5♂ —
—	—	6♂ —	—	1♂ —	—	1♂ —
—	—	— —	—	2♂ —	—	— —
37	—	2	—	1	—	18
—	—	—	—	—	—	1
1	1	6	—	6	—	4
—	1♂ —	—	—	—	—	—
—	— —	3	—	1	—	—
5♂ —	— —	2♂ —	—	—	—	2♂ —
— 1♀	— —	— —	1♂ —	—	1♂ 1♀	1♂ —
— —	— —	— —	— —	1	— —	— —
— —	— —	3♂ —	— 1♀	—	— 1♀	— —
— —	— —	1♂ —	— —	—	— —	— —
1	— —	— —	— —	10	— —	1
—	— —	— —	— —	—	— 1♀	1♂ —
6	— —	1	— —	4	— —	— —
25	42	—	— —	4	— —	— —
2	—	2	— —	5	— —	— —
1	2	—	— —	—	— —	— —
—	—	—	— —	—	24	2
2	—	—	29	—	52	6
—	—	—	—	—	—	—
—	—	—	—	—	14	2
4	—	1	23	—	11	1
8	1	2	7	—	73	1
—	—	—	12	—	—	—
—	—	—	1	—	—	—
6	—	—	14	—	—	1

	Ugaia Jan. 1–31, 1903.	Kalachonyo Plain Dec. 19–27, 1902.	Kisumu I. 25. 11. 02 –7. 2. 03.	Kisumu II. 8. 3. 03 –10. 5. 03.
PIERIDAE—continued.				
Mylothris rubricosta Mab.	—	—	9	49
„ *narcissus* f. *jacksoni* Sharpe .	1	—	—	—
Phrissura sylvia Fabr.	—	—	—	—
„ *nyassana* Butler . . .	—	—	—	—
„ *phoebe* Butler	1	—	—	—
Glutophrissa epaphia Cram. . . .	—	—	—	—
Belenois raffrayi Oberth.	—	—	—	—
„ *gidica* f. *westwoodi* Wallgr. .	10 ♂ 5 ♀	4 ♂ —	15 ♂ 2 ♀	6 ♂ —
„ *severina* f. *severina* Cram. . .	18 ♂ 3 ♂	27 ♂ —	22 ♂ 11 ♀	1 ♂ 2 ♀
„ *crawshayi* Butler . . .	— —	— —	— —	— —
„ *zochalia* f. *formosa* Butler ? .	— —	— —	— —	— —
„ *subeida* Feld.	24 ♂ 7 ♀	26 ♂ 8 ♀	16 ♂ 4 ♀	1 ♂ —
„ *calypso* Drury	— —	— —	— —	— —
„ *larima* f. *thysa* Hopff. . .	10	— —	2	2
„ *solilucis* f. *solilucis* Butler . .	7	— —	—	—
Pinacopteryx pigea f. *pigea* Boisd. . .	5	— —	1	1
„ „ f. *alba* Wallgr. . .	4	— —	—	—
„ *rubrobasalis* Lanz . .	—	— —	—	—
„ *simana* Hopff. . . .	1	— —	9	—
„ *liliana* Grose-Smith . .	—	— —	6	—
„ *dixeyi* spec. nov. . . .	—	— —	—	—
Teracolus amatus calais Cram. . . .	6	— —	—	—
„ *vestalis castalis* Staud. . .	3	— —	—	—
„ *chrysonome chrysonome* Klug .	3	— —	16	—
„ *vesta* f. *catachrysops* Butler .	4	1	—	—
„ *celimene* Lucas	—	2	—	—
„ *eris* Klug	7 ♂ 2 ♀	1 ♂ 1 ♀	1 ♂ 1 ♀	—
„ *chromiferus* Rothsch. . .	8 ♂ 1 ♀	1 ♂ —	24 ♂ 7 ♀	4 ♂ 1 ♀
„ *elgonensis* Sharpe . . .	— —	— —	— —	— —
„ *eupompe eupompe* Klug . .	23 ♂ 8 ♀	20 ♂ 2 ♀	7 ♂ 4 ♀	1 ♂ 1 ♀
„ *evippe* f. *evippe* Linn. . .	1 ♂ —	9 ♂ 1 ♀	37 ♂ —	— —
„ *achine* f. *achine* Cram. . .	6 ♂ 4 ♀	6 ♂ 2 ♀	1 ♂ —	— —
„ spec.	6 ♂ 3 ♀	8 ♂ 2 ♀	6 ♂ 2 ♀	— —
„ *antigone* f. *antigone* Boisd. .	2 ♂ 2 ♀	8 ♂ 2 ♀	16 ♂ 11 ♀	— —
„ *evarne* f. *evarne* Klug . .	5 ♂ 4 ♀	— —	10 ♂ 3 ♀	— —
„ *auxo* f. *auxo* Lucas . . .	15 ♂ 5 ♀	7 ♂ —	30 ♂ 12 ♀	1 ♂ —
Eronia cleodora f. *erxia* Hew. . . .	6	— —	20	— —
„ *leda* f. *leda* Boisd.	13 ♂ 3 ♀	— —	6 ♂ —	8 ♂ 1 ♀
Luceronia argia f. *argia* Fabr. . . .	— —	— —	— —	— —
„ *pharis* Boisd.	1	— —	— —	— —
„ *thalassina* Boisd. . . .	—	— —	— —	— —
„ *buqueti* f. *capensis* Hopff. . .	3	— —	— —	— —
Catopsilia florella Fabr.	11 ♂ 14 ♀	3 ♂ 3 ♀	1 ♂ 3 ♀	1 ♂ 1 ♀
Terias senegalensis f. temp. *bisinuata* Butler	8	17	16	1
„ *desjardinsi* f. *regularis* Boisd. . .	5	6	4	—
„ *brigitta* f. *brigitta* Cram. . . .	8	26	20	2
Colias electo Linn.	19	—	—	—

Nyangori I. 1. 11. 02 -5. 12. 02.	Nyangori II. 27. 1. 03.	Nyangori III. 25. 3. 03 -26. 4. 03.	Tiriki Hills 20. 2. 03 -20. 3. 03.	Usemi May 1903.	Entebbe April 1-12, 1903.	Toro Nov.-Dec. 1900.
2	—	—	3	—	1	—
—	—	—	—	—	—	—
—	—	—	10	—	2	4♂ 1♀
2	—	—	—	—	—	1
—	—	2	—	—	—	—
1♂ —	—	1♂ —	32♂ —	—	—	17♂ —
— —	—	— —	43♂ 6♀	—	—	— —
— —	—	— —	1♂ —	5♂ 1♀	—	1♂ —
8♂ 1♀	—	1♂ —	3♂ 2♀	4♂ 5♀	—	27♂ 1♀
— —	—	— —	1	— —	—	8
— —	—	— —	27♂ 4♀	— 1♀	—	17♂ —
1♂ 1♀	—	4♂ —	16♂ 7♀	9♂ 3♀	—	3♂ —
— —	—	— —	— —	— —	—	14
— —	—	— —	— —	— —	—	—
— —	—	3	— —	— —	—	31
— —	4	—	— —	— —	—	—
— —	—	—	— —	— —	—	34
— —	—	—	— —	— —	—	4
— —	—	—	— —	— —	—	1
— —	—	—	— —	— —	—	—
— —	—	—	— —	— —	1	12.
— —	—	—	— —	— —	—	—
— —	—	—	— —	— —	—	—
— —	—	—	— —	3	—	1
— —	—	—	— —	—	—	—
— —	—	—	— —	—	—	—
— —	—	—	— —	—	—	—
— —	—	—	— —	6♂ 3♀	—	—
— —	—	—	1♂ —	— —	—	1♂ —
— —	—	—	— —	2♂ —	—	— —
— —	—	—	2♂ —	3♂ —	—	1♂ —
— —	—	—	— —	— 2♀	—	2♂ —
— —	—	—	— —	2♂ —	—	— —
— —	—	—	— —	11♂ 4♀	—	— —
— —	—	—	— —	5♂ 1♀	—	— —
— —	—	—	— —	7♂ 2♀	—	— —
— —	—	—	— —	3	—	— —
— —	—	—	— —	— 1♀	—	12♂ —
6♂ 5♀	—	5♂ 4♀	7♂ 2♀	— —	—	— —
— —	—	—	2	— —	—	— —
1♂ —	—	—	3♂ —	— —	—	— —
— —	—	—	— —	— —	—	— —
25♂ 31♀	—	—	5♂ 4♀	6♂ 2♀	—	17♂ 4♀
5	—	4	2	3	6	8
8	—	—	2	4	—	16
5	—	—	—	28	—	—
1	—	—	—	—	—	—

	UGAIA Jan. 1–31, 1903.	KALACHONYO PLAIN Dec. 19–27, 1902.	KISUMU I. 25. 11. 02 –7. 2. 03.	KISUMU II. 8. 3. 03 –10. 5. 03.
PAPILIONIDAE.				
Papilio rex Oberth.	—	—	—	—
,, ,, f. intermediate toward *mimeticus* Rothsch. . . .	—	—	—	—
,, ,, *nobilis* Rogenh. . . .	1	—	—	—
,, *dardanus* Brown.	1♂ —	—	—	2♂ —
,, ,, ♀-f. *hippocoon* Fabr. .	— —	—	—	— —
,, ,, ♀-f. *planemoides* Trim.	— —	—	—	— —
,, ,, *homeyeri* Plötz . .	— —	—	—	— —
,, ,, *cynorta* Fabr. . .	— —	—	—	— —
,, ,, *peculiaris* spec. nov. .	— —	—	—	— —
,, ,, *zenobia zenobia* Fabr. .	— —	—	—	— —
,, ,, *gallienus whitnalli* nov. .	— —	—	—	— —
,, ,, *hesperus* Westw. . .	— —	—	—	— —
,, ,, *mackinnoni* Sharpe .	— —	—	—	— —
,, ,, *phorcas phorcas* Cram. .	1	—	—	— —
,, ,, ,, ♀-f. *thersander* Fabr. . .	—	—	—	— —
,, ,, *nireus nireus* Linn. .	—	—	—	— —
,, ,, *lyaeus* Dbl. . . .	1	—	—	— —
,, ,, *bromius brontes* Dbl. & Godm. . . .	3	—	—	— —
,, ,, *demodocus* Esp. . .	2	—	9	1
,, ,, *menestheus lormieri* Dist.	—	—	—	—
,, *ridleyanus* White	—	—	—	—
,, *pylades* f. *angolanus* Fabr. . .	32	1	—	—
,, *leonidas leonidas* Fabr. . . .	—	—	—	—
,, *policenes* Cram.	—	—	—	—
HESPERIIDAE.				
Sarangesa djaelaelae Wallgr. . . .	3	—	—	2
,, *perpaupera* Holl. . . .	7	—	5	5
,, *synestalmenus* Karsch. . .	1	—	—	—
,, *pertusa* Mab.	1	—	5	—
,, sp. ?	—	—	—	—
,, *thecla* Plötz ?	—	—	—	—
Celaenorrhinus opalinus Butler . . .	3	—	—	—
,, *proximus* Mab. . . .	—	—	—	1
Tagiades flesus Fabr.	—	—	—	—
,, *lacteus* Mab.	—	—	—	—
Eagris plicata Butler	—	—	—	—
,, *lucetia* Hew.	—	—	—	—
Caprona canopus Trim.	3	—	—	—
Hesperia spio Linn.	—	—	—	—
,, *machacosa* Butler . . .	—	—	3	1
,, *ploetzi* Auriv.	—	—	—	—
Carcharodus elma Trim.	—	—	—	1

Nyangori I. 1. 11. 02 -5. 12. 03.	Nyangori II. 27. 1. 03.	Nyangori III. 20. 3. 03 -26. 4. 03.	Tiriki Hills 23. 2. 03 -20. 3. 03.	Usemi May 1903.	Entebbe April 1-12, 1903.	Toro Nov.-Dec. 1900.
2♂ —	—	—	—	—	—	—
2♂ 2♀	—	—	—	—	—	—
—	—	—	—	—	—	—
17♂ —	—	7♂ —	6♂ —	—	10♂ —	3♂ —
2	—	3	2	—	— —	— —
1	—	—	—	—	— —	— —
2♂ —	—	2♂ 1♀	22♂ —	—	1♂ —	6♂ 2♀
— —	—	— —	— —	—	— —	7♂ 1♀
— —	—	— —	— —	—	— 1♀	— —
— —	—	— —	— —	—	— —	49
— —	—	— —	— —	—	6	—
— —	—	— —	— —	—	3	—
— —	—	— —	26	—	—	—
11	—	2	9♂ 2♀	—	—	7
1	—	—	— —	—	—	—
13	—	2	— —	—	6	14
2	—	—	— —	—	3	—
6	1	2	28	—	1	10
6	—	3	1	1	5	8
—	—	—	4	—	6	—
—	—	—	—	—	4	4♂ 1♀
1	—	5	—	—	—	— —
1	—	3	—	—	3	1
11	—	4	6	—	1	—
—	—	—	—	—	—	—
6	—	3	2	—	1	1
—	—	—	—	1	—	—
—	—	—	—	1	—	—
—	—	—	—	—	—	2
2	—	—	—	—	—	—
1	—	—	2	—	1	—
—	—	—	1	—	—	2
8	—	1	—	—	3	—
—	—	—	—	—	—	1
—	—	—	1	—	—	—
2	—	2	—	—	—	—
—	—	—	—	—	—	—
2	—	1	—	—	—	—
1	—	1	1	3	—	—
—	—	—	2	—	—	—
—	—	—	—	—	—	—

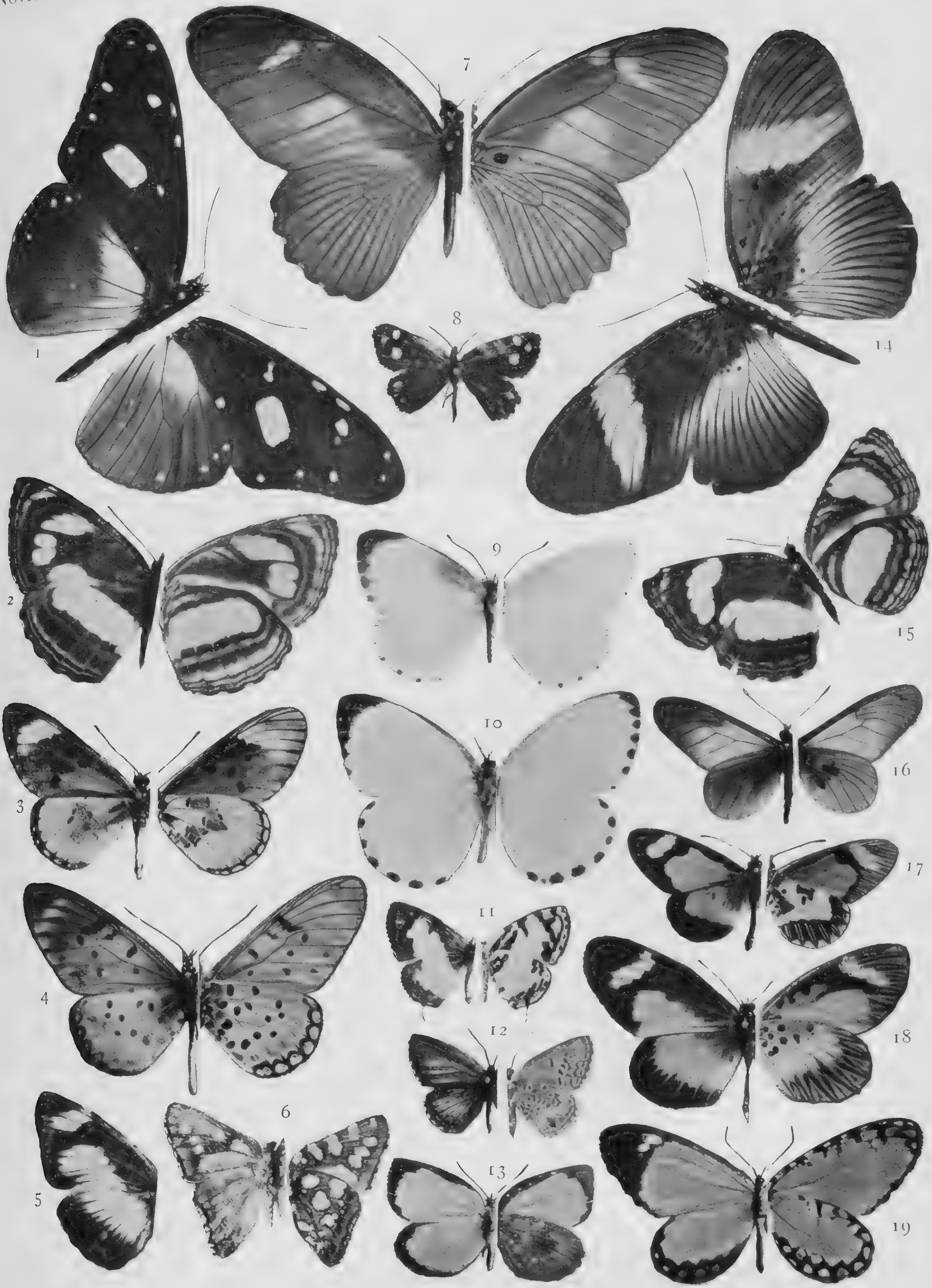
	Ugaia Jan. 1–31, 1903.	Kalachonyo Plain Dec. 19–27 1902.	Kisumu I. 25. 11. 02 –7. 2. 03.	Kisumu II. 8. 3. 03 –10. 5. 03.
HESPERIIDAE—continued.				
Acleros ploetzi Mab.	—	—	—	—
„ *placidus* Ploetz	—	—	—	—
Oxypalpus ignita Mab.	—	—	—	—
Hypoleucis ophiusa Hew.	—	—	—	—
Cyclopides metis Linn.	—	—	—	—
„ *willemi* Wallgr.	—	2	—	—
„ spec. near *formosus* Butler.	—	—	—	—
„ *trisignatus* spec. nov.	—	—	—	—
„ *midas* Butler	1	—	1	—
„ *lepeletier* Godt.	1	—	—	—
Kedestes mohozutza Wallgr.	3	—	—	—
Gegenes hottentota Godt.	—	—	—	—
„ *obumbrata* Trim.	1	—	—	—
Padraona zeno Trim.	1	—	—	—
Chapra mathias Fabr.	2	—	—	—
Parnara borbonica Boisd.	1	—	—	1
„ *detecta* Trim.	—	—	—	1
„ *micans* Holl.	—	—	—	—
Semalea pulvina Ploetz	1♂ —	—	—	—
Baoris mohozutya Wallgr.	—	—	—	—
„ *auritinctus* Butler	1	—	—	—
Kedestes albicornis Butler	1	—	—	—
Parosmodes moranti Trim.	—	—	—	—
Pardaleodes edipus Cram.	—	—	—	—
„ *incerta* Snell.	3	—	—	—
„ *vibius* Hew.	—	—	—	—
Ceratrichia flava Hew.	—	—	—	—
Andronymus philander Hopff.	—	—	—	—
„ *neander* Plotz.	—	—	—	—
Gamia galua Holl.	—	—	—	—
Artitropa margaritata Holl.	—	—	—	—
Rhopalocampta anchises Gerst.	1	—	—	—
„ *forestan* Cram.	5	1	1	1

Note.—Besides the species of *Ipthima* mentioned in the list, there are in the collection specimens of *Ipthima itonia* Hew. from Toro, and of a species allied to, if not the same as, *Ipthima asterope* Klug from Ugaia, Kisumu, and Nyangori.

NYANGORI I. 1. 11. 02 –5. 12. 02.	NYANGORI II. 27. 1. 03.	NYANGORI III. 25. 3. 03 –26. 4. 03.	TIRIKI HILLS 20. 2. 03 –20. 3. 03.	USEMI May 1903.	ENTEBBE April 1–12, 1903.	TORO Nov.–Dec. 1900.
—	—	—	1	—	1	—
—	—	—	—	—	1	—
—	—	—	—	—	—	7
—	—	—	—	—	—	1
—	—	—	2	—	—	2
—	—	—	—	—	—	—
—	—	—	—	—	—	1
—	—	—	—	—	1	—
3	—	1	—	—	—	2
—	—	—	1	—	—	—
—	—	—	—	—	—	—
19♂ —	—	—	—	—	—	—
— —	—	—	—	—	—	—
— —	—	—	1	—	—	3
— —	—	—	—	—	1	—
1	—	—	—	—	1	—
—	—	—	—	—	—	1
—	—	—	—	—	—	1
1♂ —	—	—	—	—	— 1♀	—
— —	—	1	—	—	1	—
— —	—	—	—	1	—	—
— —	—	—	—	—	—	—
1	—	—	—	—	—	—
—	—	—	—	—	1	—
1	—	—	—	—	6	1
—	—	—	—	—	1	—
—	—	—	1♂ 1♀	—	—	—
1	—	—	— —	—	—	—
—	—	—	— —	—	—	16
—	—	—	— —	—	1	—
—	—	—	— —	—	3	—
—	—	—	— —	—	—	—
4	—	—	2	—	1	10

The nomenclature of varieties is not quite consistent, but, owing to my departure for Africa, there was no time to go through the matter again.

PLATE I.



Art Reproduction Co., Ltd.

[*From "Novitates Zoologicae." Vol. XVIII. September*, 1911.]

PRELIMINARY DESCRIPTIONS OF SOME NEW OR LITTLE-KNOWN FORMS OF THE GENUS *ACRAEA*.

BY H. ELTRINGHAM, M.A., F.E.S., F.Z.S.

BEING engaged in the preparation of a monograph on the African species of the genus *Acraea*, I have had opportunities of examining very large numbers of examples from many collections. As a considerable time must elapse before the completion of the work in question, I think it well to publish the following notes on certain new forms. Figures and more complete descriptions will be included in the completed monograph.

1. **Acraea aureola** spec. nov.

♂. *Upperside* rich golden yellow with black spots and markings.——Forewing narrow and pointed, base very slightly suffused with black ; ground-colour of basal portion rather richer in colour than remainder; costa narrowly black, except at base ; subcostal, upper radial, and distal ends of remaining nervules black ; hindmargin narrowly black, expanded into small triangular marks at end of nervules ; a large ovate transverse spot in cell above origin of first median ; a subquadrate spot on upper part of end of cell ; a little beyond cell an outwardly convex row of five rather small rounded spots ; beneath these, nearer base, and between first and second median, a rounded spot; below first median a small, rather crescentic submarginal spot, and a very small subbasal spot close to median.——Hindwing rather paler than forewing; a moderately heavy black basal suffusion ; in area 7 a subbasal spot followed by a larger transverse spot near middle of costal margin ; beneath first subcostal a submarginal spot ; in middle of cell a transverse V-shaped spot, the angle pointing outwards; remaining basal spots obscured by basal suffusion ; hindmargin with a very narrow black line, and a series of well-marked regular black arches.

Underside.—Forewing resembling upperside but paler and duller; apical portion pinkish ochreous; nervules not black, and without triangular marginal marks. No basal suffusion.——Hindwing pinkish ochreous ; the basal portion lemon ochreous, except above the subcostal ; a round black spot near base of cell followed by a V-shaped spot as on upperside ; beneath median a basal spot followed by another V-shaped mark, and a spot in 1 *a* and 1 *b* ; other marks as on upperside.

Head and thorax brown ; basal part of abdomen black, remainder orange ; tarsal claws asymmetrical.

Expanse, 60 mm.

1 ♂, Bihé, Angola; Mus. Tring.

Apparently allied to *A. onerata* Trimen, but very distinct. The genital armature is of a very peculiar structure, unlike that of any other *Acraea* so far examined.

2. **Acraea lofua** spec. nov.

♂. Forewing dull pinkish ochreous, with a very slight black basal suffusion; apex black for a depth of 3 mm.; hindmargin very narrowly black; black spots (very small) as follows: one in cell, one on end of cell, a row of four beyond cell, the third linear, its lower end pointing outwards; one in area 2, close to median, and one in 1 *b*, nearer margin.——Hindwing more decidedly pink than forewing; a black basal suffusion; two spots in cell, the remaining basal spots obscured by the black suffusion; a row of five discal spots lying almost in a straight line from near apex to inner margin; two spots in area 7; a heavy black hindmarginal border, 5 mm. wide between first and second median, and tapering off at hind angle.

Underside much paler than above.——Forewing as on upperside, but spots less distinct, no basal, and very little apical black.——Hindwing with faint pinkish basal internervular markings; very slight basal black suffusion, and in addition to spots as on upperside, one in 1 *c*, and two in 1 *b* and 1 *a*. Hindmarginal black, narrower in the middle than on upperside, its inner edge sharply dentate, and bearing a submarginal row of seven triangular greyish white spots, their bases towards the margin.

Head brown; thorax black; abdomen black above with yellowish lateral spots; tarsal claws asymmetrical.

♀. Pale dull ochreous.——Forewing slightly darker near base; apical black rather broader than in ♂, but all the spots absent except that on end of cell, and the second of the discal row (this very minute).——Hindwing with faint dusky basal suffusion; spots absent or very faint; hindmarginal black, narrower in middle than in ♂.

Underside.—Forewing paler than on upperside, the two spots just visible, but apical black only faintly represented.——Hindwing only a faint trace of the discal spots; basal spots small and indistinct; hindmarginal black, 2·5 mm. wide, not dentate, bearing greyish white submarginal spots though smaller and less distinct than in ♂. Abdomen black with whitish lateral spots.

Expanse, ♂ 46 mm.; ♀ 48 mm.

1 ♂, 1 ♀, Lofu River, N.E. Rhodesia; Mus. Oxon.

Nearly allied to *A. omrora* Trimen, and easily confused with this species. The ♂ genital armature is however very distinct, and bears a pair of supplementary processes between the harpes.

3. **Acraea iturina kakana** subspec. nov.

♂. Forewing: base and costa blackish. Apical half semi-transparent, basal half including cell dull orange-red; apex, hindmargin, and distal edge of red area rather more thickly scaled with black than the remainder. The transparency is caused by reduction in width of the scales; the red area extends slightly into area 3, about half the length of areas 1 *b* and 2, and nearly to hind-angle in area 1 *a*. ——Hindwing dull orange-red; a basal aggregation of confluent black spots; a discal band of large confluent spots, the first in area 7 about the middle, the remainder lie almost in a straight line across the wing, except that in area 3, which is more distally placed; a blackish hindmarginal border about 2 mm. wide at apex becoming rather suddenly narrower at nervule 5, and tapering to anal angle.

Underside resembles the upper, but is sparsely scaled, and the red areas are dull pink; the hindwing basal spots are somewhat less confluent and can be

resolved into a large subbasal spot in 7, two confluent subbasal spots in cell, one in 1 *c*, 1 *b*, and 1 *a* ; in the latter area also a minute dot beneath end of nervule 1 *a* ; a little black at origin of main nervures.

Head, thorax, and abdomen black, the latter with indistinct brownish lateral spots ; tarsal claws asymmetrical. In forewing nervures 6 and 7 arise, not from cell, but from a common stalk about 1 mm. long, as in *iturina*.

A superficial examination of this form would lead to the conclusion that it was a distinct species. It differs from *iturina* in the absence of the spot in forewing cell, the deeper colour and greater extent of the red areas, and the larger size of the spots. But the peculiarity of the hindwing neuration and the characteristic toothed appearance on inner side of the claspers of the ♂ armature convince me that it is the Abyssinian form of *A. iturina*.

Expanse, 50 mm.

1 ♂, Adie Kaka, Kaffa ; Mus. Brit.

4. **Acraea oscari** Roths.

So far as I am aware, the ♀ of this species has not been described.

♀. Spots and markings as in ♂, but ground-colour pale creamy ochreous, somewhat darker at inner edge of hindwing hindmarginal border.

Underside resembles upper, but hindwing more lemon ochreous, and areas 1 *a* and 1 *b* brick-red.

Expanse, 84 mm.

Bonga, Kaffa ; Mus. Brit.

5. **Acraea cinerea alberta** subspec. nov.

♂. Resembles *cinerea* Neave, but the discal portion of hindwing is occupied by a patch of deep crimson.

Expanse. 54 mm.

2 ♂♂, L. Albert Edward, 1000 m. ; Mus. Tring.

6. **Acraea astrigera** f. **brunnea** nov.

♂. Wings more rounded than in *astrigera* Butl., ground-colour dull smoky ochreous, usually with a whitish subapical patch in place of the orange of *astrigera*, and apex more broadly black.

Underside much as in *astrigera*, but forewing pale smoky ochreous, subapical area white. Discal portion of hindwing pale pinkish ochreous.

♀. Wings much more rounded, coloured and marked as in ♂, but hindwing hindmarginal border very broad (about 7 mm.).

Expanse, ♂ ♀ 70 mm.

5 ♂♂, Angola ; Mus. Tring. 2 ♀♀, Unyoro and Masindi (Unyoro) ; Mus. Tring. 1 ♀, Entebbe ; Mus. Oxon.

Acrea astrigera Butl. exhibits several interesting forms. A fine series now before me shows many intermediates, and a careful examination of the male armature shows that *A. astrigera* Butl., *A. emini* Weymer, and *A pseudolycia* Butl. are all forms of the same species.

7. **Acraea ella** spec. nov.

Closely resembles *A. equatorialis* Neave.* It is distinguished from it by its uniformly larger size, darker colour, much heavier scaling, wider black basal

* Neave's *A. doubledayi equatorialis* is not a form of *doubledayi*, but is a distinct species.

suffusion in hindwing, and by the fact that the discal spot in forewing, 1 *b*, is slightly nearer margin than the spot above it in 2, whereas in *A. equatorialis* this spot is further from margin, and by other minor details.

The male armature is different from that of *A. equatorialis*.

♂. Forewing dull to bright or pinkish ochreous; costa, apex, and hindmargin very narrowly black; base with slight or moderate dusky suffusion; area just beyond discal row of spots rather paler, and apical area more richly coloured; black internervular streaks on apex and hindmargin; a black spot in cell, one on discocellular; a row of five beyond cell, and nearly in a straight line at right angles to costa; a spot near base of area 2; beneath it and slightly more distally placed a spot in 1 *b*, and in same area a subbasal spot 2 mm. before origin of nervule 2.——Hindwing: ground-colour same as in primary, sometimes rather paler; spots corresponding with those beneath, but faint near inner margin; a moderately wide black basal suffusion, and a narrow hindmarginal border formed of a narrow black marginal line and rather flat internervular arches enclosing spots of ground colour.

Underside. Forewing as above, but paler, and spots smaller; two small spots at base of costa.——Hindwing duller than above, base touched with rose-pink, followed by pale ochreous; marginal border more sharply traced than above, and enclosing pale ochreous spots; black spots, one in 8 near precostal, two in 7; discal spots in 6, 5, 4, 3, 2, 1 *c*, 1 *b*, and 1 *a*; two in cell, a basal and a subbasal in 1 *c*; beneath the former a spot in 1 *b*, and a basal spot in 1 *a*; a spot at base of 5 on M.D.C.

Head and thorax black with brown tufts; base of abdomen black with pale lateral spots; remainder white or yellowish.

Expanse, 50—60 mm.

4 ♂♂, 1 ♀, Bihé, Angola; Mus. Tring.

8. **Acraea periphanes** Oberthür.

An examination of a fine series of this species in the Hope Department at Oxford shows that this extremely variable *Acraea* presents five fairly well-defined forms including the type. These variations are neither seasonal nor geographical. They may be classified as follows:

8 *a*. *A. periphanes* f. *beni* B.-Bak.

Acraea beni Bethune-Baker, *Proc. Zool. Soc.* p. 110 (1908).

This form is characterised by the uniform bright red ground-colour and the absence of the black apical patch in the forewing.

Hab. Angola, Lower Chambesi, L. Bangweolo.

8 *b*. *A. periphanes* f. *melaina* nov.

Differs from typical examples in having a heavy black basal suffusion in both wings. The hindwing margin is broad with only a trace of pale spots. In the ♂ it radiates into the discal area, and in the ♀ has a more regular though suffused inner edge, and is widest (about 4·5 mm.) at 1 *c* and 2.

Hab. Lower Chambesi, L. Bangweolo.

8 *c*. *A. periphanes* f. *marginata* nov.

Resembles the *melaina* form, but is without the black apex in forewing. The spots are larger in most examples than in the typical form.

Hab. Lower Chambesi, L. Bangweolo.

8 *d*. *A. periphanes* f. *acritoides* nov.

Differs from typical examples in having more elongated wings, and in the absence of both the apical black patch and the discal spots of forewing. These differences produce a very close resemblance to *A. acrita*, as already noted by Neave (*Proc. Zool. Soc.* p. 20, 1910).

Hab. Chinsali District, Lower Chambesi, L. Bangweolo.

The structure of the male genital armature in *A. periphanes* is very peculiar, and separates it very definitely from allied species. The structure is the same in all the above-described forms.

9. **Acraea mansya** spec. nov.

♂. Differs constantly from *A. chambezi* * (Neave, *P.Z.S.* p. 21. pl. 1. fig. 5. 1910) in one feature only. The spot in area 3 of hindwing is in the middle of the space between end of cell and the inner edge of the marginal black, whereas in *A. chambezi* this spot is close to end of cell. Two very small ♂♂ are dull orange ochreous instead of rosy red.

♀. Dull smoky ochreous inclined to orange in apical area of forewing; spots and markings as in ♂.

I should not have regarded this as a distinct species had it not been for the structure of the genitalia. In *chambezi* the claspers are short, broad, and toothed. In *mansya* they are long, narrow, cylindrical, and without teeth. The armature of the latter species is entirely different from that of any other *Acraea* so far examined.

Expanse, ♂ 40—50 mm.; ♀ 40.

5 ♂♂, 1 ♀, near L. Young, N.E. Rhodesia; Mus. Oxon.

* Neave's *A. nohara chambezi* is not a form of *nohara*, but is a distinct species.

[*Extracted from the* LINNEAN SOCIETY'S JOURNAL—ZOOLOGY, vol. xxx. *March* 1908.]

ÆNIGMATISTES AFRICANUS, a new Genus and Species of Diptera.

By R. SHELFORD, M.A., F.L.S.

(PLATE 22.)

[Read 7th November, 1907.]

QUITE recently, Professor E. L. Bouvier of the Muséum d'Histoire Naturelle, Paris, entrusted to me for examination a minute insect from British East Africa, bearing a superficial resemblance to a cockroach. The unique specimen was gummed on to a piece of card, so that little could be made out of its external anatomy when examined with a simple pocket-lens ; however, when the specimen had been soaked off the card and placed under a microscope, it was at once seen that it had no affinities with the Orthoptera. I am indebted to Dr. H. J. Hansen of Copenhagen, whom I was fortunate enough to meet in London, for giving me a clue to the real nature of the insect. There can be little doubt that the insect's nearest known ally is *Ænigmatias blattoides*, an aberrant Phorid fly described by Meinert from Denmark [**1***] in 1890 ; but the relationship, as might be expected from the very different localities of the two insects, is not at all close, in fact the differences between them are almost as striking as the resemblances. The following is a description of the new genus :—

ÆNIGMATISTES †, gen. nov.

Head prominent, subpyramidal ; the morphologically anterior part lies in a plane almost at right angles to the plane of the posterior part and the middle region of the frons is produced and sharply ridged, making the angulation more pronounced. The head when viewed from above is concave and the vertex projects above the level of the pronotum. The frons immediately below the ridge is slightly concave, but then becomes strongly convex. On either side of the head is situated a deep depression in which lies the antenna.

The *eyes* have few facets, are somewhat pyriform in outline, and are placed laterally at the postero-ventral angles of the head (Pl. **22**. fig. 3). A stout seta, upwardly curved, springs from a point just below each eye. *Ocelli* absent.

The *antennæ* (Pl. **22**. fig. 4) are composed of 7 visible joints. The first is large, swollen and trapezoidal, the third is large and globular ; the second is a connecting joint between the first and third and in surface view appears to be short and slender, in optical section it appears to expand within the

* These numbers refer to the Bibliography at the end of this paper.

† αἰνιγματιστής, one that propounds riddles.

third joint. The remaining joints form a slender flagellum, the last joint being very long and lash-like.

The *mouth-parts* are much reduced and consist of (1) a trapezoidal and strongly deflexed labrum ; (2) a pair of two-jointed maxillary palpi, the first joint minute, membranous, the second elliptical, hirsute ; (3) a minute, membranous hypopharynx with a bifid apex directed inwards and overlying the entrance to the pharynx (Pl. **22.** fig. 5). There is no *labium*.

Thorax of three segments : the pronotum large and crescentic ; the mesonotum lenticular in outline ; the metanotum with the anterior margin concave, the posterior margin straight. The mesonotum is enclosed between the pro- and metanotum and fails to reach the lateral margins of the thorax ; the lateral borders of the other thoracic tergites overlap on to the ventral surface. Ventrally the cuticle is thin and membranous and only shows faint traces of sternal sclerites ; a fine suture runs down the middle line of the ventral surface. An inwardly-directed seta springs from the antero-lateral margin of the pronotum.

Abdomen of four segments ; the first three tergites transverse and shorter than the last which is subtriangular ; the lateral borders of the first three overlap on to the ventral surface, which is covered with a thin, membranous cuticle showing no signs of segmentation.

Legs.—*1st pair.* Coxæ elongate, broad, flattened, the coxal cavities small, circular and widely separated ; femora flattened, about equal in length to the coxæ but narrower ; tibiæ almost cylindrical, about $\frac{3}{5}$ length of femora, with one spine at the apex ; tarsi 5-jointed, the last joint with two claws, no pulvilli.

2nd pair. Coxæ trapezoidal, excavate and flanged on the outer aspect ; femora longer and broader than those of the first pair, their lower margin sinuate towards apex ; tibiæ cylindrical, equal in length to the femora, with three spines at the apex ; tarsi similar to the first pair but more spinose.

3rd pair. Coxæ narrower and more elongate than the preceding pair ; femora broader ; tibiæ tapering from apex to base, with six spines at the apex ; [tarsi missing].

Æ. AFRICANUS, sp. nov. (Pl. **22.** figs. 1 & 2.)

Depressed, convex above. Piceous above, pale testaceous below ; antennæ pale testaceous. Minutely punctate above and with a fine recumbent pubescence which extends also on to the legs.

Total length 2·5 mm.

Hab. Kisumu, Victoria Nyanza, Brit. Central Africa (*Ch. Alluaud*, 1904). Type in the Paris Museum.

I cannot be certain of the sex of the specimen, but suppose it to be a female ; the unique specimen of *Ænigmatias blattoides* is considered by Meinert to be a female, though Coquillett [**5**] throws doubt on this and

regards a specimen of another species, *Æ. Schwarzii*, taken recently in Arizona, as a male. Until sufficient material for dissection is obtained it is not possible to settle the question of the sexes of these aberrant Diptera with any degree of certainty. It has been suggested that *Platyphora Lubbocki*, Verrall, is the male of *Ænigmatias blattoides*, but this is open to very considerable doubt.

Attention may be drawn here to some other remarkable Diptera which Brues [**9**], a leading authority on the Phoridæ, considers ought to be retained in that family; he promises in the near future a paper treating of the relations of these aberrant forms to more normal types.

In 1897 Dahl [**2**] described from the Bismarck Archipelago a wingless fly, found on carrion and also on an Aroid, with an offensive odour, of the genus *Amorphophallus*. This insect, on account of a very superficial resemblance to a flea, was regarded as intermediate between the fleas and true flies, was named *Puliciphora lucifera*, and was made the type of a new family Puliciphoridæ. Wandolleck [**3**] subsequently re-examined Dahl's specimen, and described in some detail its anatomy together with that of another species from the Bismarck Archipelago—*Chonocephalus dorsalis*—and of a third from Liberia, a form parasitic on land-molluscs of the genus *Achatina*. The last species, though described, was not named by Wandolleck, but has since been named *Wandolleckia Cooki*. Wandolleck, in his memoir on these three species, heaps scorn on Dahl's view of their affinities, re-christens *Puliciphora lucifera* as *Stethopathus ocellatus* and the Puliciphoridæ as Stethopathidæ. Though there cannot be the slightest doubt that these Diptera have no real affinity with *Pulex*, the rules of priority in nomenclature forbid the supplanting of a valid name, however great the absurdity that is so commemorated; *Stethopathus ocellatus*, Wand., must consequently sink as a synonym of *Puliciphora lucifera*, Dahl. Breddin and Börner [**6**] described in 1904, under the name of *Thaumatoxena Wasmanni*, a remarkable insect found in a termite's nest in Natal; this they consider to be not only the type of a new family Thaumatoxenidæ, but also the type of a new sub-order of Rhynchota, the Conorrhyncha. Börner later [**7**] discussed the relation of this insect to the other orders of Hexapoda. Silvestri [**8**] in 1905 published an account of another species of the same genus, *Th. Andreinii*, and came to the conclusion that the genus is referable to the family Puliciphoridæ (= Stethopathidæ of Wandolleck). The insect is very remarkable in appearance, the abdomen being covered above and below with a single large scutum, three minute telescope-like segments alone projecting from the ventral surface towards its apex; but the antennæ are typically Phorid in character, and the mouth-parts, judging from figures, are sufficiently like those of *Puliciphora*, *Chonocephalus*, and *Wandolleckia* to warrant a belief that *Thaumatoxena* is merely an extreme modification of the Phorid type, brought about perhaps by its termitophilous

habits. Brues in his latest monograph on the Phoridæ [9] does not include *Thaumatoxena*, but it is possible that he did not receive Silvestri's paper in time to draw his attention to the fact that the position of *Thaumatoxena* in the order Rhynchota was a very precarious one. Wasmann [4] has described some other termitophilous genera, *Termitoxenia* and *Termitomyia*, which he would include in yet another family, the Termitoxenidæ; they appear to have some features in common with *Thaumatoxena*; Brues includes them in the Phoridæ. Their development is very remarkable, since they undergo no metamorphosis, and *Termitomyia* is also viviparous.

Except in the shape of the head, which resembles the head of *Chonocephalus*, and in the form of the antennæ, which is characteristically Phorid in appearance, *Ænigmatistes* is very unlike all the foregoing genera. *Thaumatoxena* is a form apart, the most outlying member of all. The "Puliciphoridæ" are characterized by the small thorax, swollen abdomen with thin cuticle and isolated scutes, and the long legs. Moreover, in all the genera enumerated above, the rostrum is prominent and is composed of easily recognizable and separate elements. In *Ænigmatias* the rostrum has not been properly demonstrated, but if it exists it is certainly minute and rudimentary. Both in *Ænigmatias* and *Ænigmatistes* the head fits closely to the thorax, and in the latter genus, at any rate, it is incapable of much movement owing to its projection above the level of the pronotum; the labrum is deflexed and covers the entry to the mouth quite completely. In an attempt to raise the labrum of my specimen and examine the mouth-parts *in situ*, the head broke away from the thorax so that the position of the trophi was considerably disturbed. I am, however, confident that no portion of the mouth-parts was lost, and so can affirm with certitude that the proboscis or rostrum of *Ænigmatistes* is represented by a minute membranous hypopharynx which is quite invisible until the labrum, covering it, is removed. This reduction of the mouth-parts alone is sufficient to remove *Ænigmatistes* and *Ænigmatias* from the neighbourhood of the other aberrant genera of Phoridæ described above. It is difficult to see how the insect can feed, since it is provided merely with a pair of maxillary palpi and a rudimentary hypopharynx, and the same may be said of *Ænigmatias blattoides*. *Æ. blattoides* was found in company with ants, and it has been suggested to me that it is fed by the ants thrusting their jaws into the mouth of their guest and regurgitating some liquid nourishment from their crops, very much as the Staphylinid beetle *Atemeles marginata*, Gravenh., is fed by ants. The suggestion was sufficiently ingenious to lead me to examine the mouth-parts of the Staphylinid in question, in the hopes of discovering at least some reduction thereof to lend support to this view, but I was doomed to disappointment, for the mouth-parts in this species are perfectly well-formed. Moreover, I cannot find an instance of the reduction of mouth-parts in any other myrmecophilous or termitophilous insects; and the fact that *Ænigmatias Schwarzii* was not taken in the company of

ants almost disposes of the suggestion that these species have to be fed by attendant hosts. Unfortunately, nothing is known of the habits of *Ænigmatistes*; the unique specimen was found in a miscellaneous collection of insects sent to the Paris Museum by M. Ch. Alluaud.

The following are the characters in which *Ænigmatistes* resembles *Ænigmatias*:—

Cockroach-like appearance.
Strongly chitinized head and tergites.
Form of antennæ.
Form of maxillary palpi.
Division of thorax into three visible segments.
Abdomen beneath covered with an unsegmented membranous cuticle.
Form of legs.
Absence of tarsal pulvilli.

The following are the characters wherein *Ænigmatistes* differs from *Ænigmatias*:—

Shape of the head.
Position of the eyes.
Absence of ocelli.
Large size of the pronotum.
Form of the mesonotum and metanotum.
Four visible abdominal segments only.

Bibliography.

1. Meinert, F.—"*Ænigmatias blattoides*. Dipteron novum apterum." Entomol. Medd. vol. ii. pp. 213–226, pl. iv. (1890).
2. Dahl, F.—"*Puliciphora*, eine neue flohähnliche Fliegengattung." Zool. Anz. 1897, pp. 409–412.
3. Wandolleck, B.—"Die Stethopathidæ, eine neue flügel- und schwingerlose Familie der Diptera." Zool. Jahrb., Abth. Syst. vol. ii. pp. 412–441, plates 25 & 26 (1898).
4. Wasmann, E.—"*Termitoxenia*, ein neues flügelloses, physogastres Dipterengenus aus Termitennestern." Zeitschr. wiss. Zool. vol. lxvii. pp. 599–617, pl. 33 (1900), and vol. lxx. pp. 289–298 (1901).
5. Coquillett, D. W.—"The occurrence of the Phorid genus *Ænigmatias* in America." Canad. Ent. vol. xxxv. pp. 20–22 (1903).
6. Breddin & Börner, C.—"Ueber *Thaumatoxena wasmanni*, der Vertreter einer neuen Unterordnung der Rhynchoten." Sitz.-Ber. Ges. naturf. Freunde, Berlin, 1904, pp. 84–93.
7. Börner, C.—"Zur Systematik der Hexapoden." Zool. Anz. 1904, pp. 511–533.

8. Silvestri, F.—" Contribuzione alla conoscenza dei Termitidi e Termitofili dell' Eritræa." Redia, vol. iii. pp. 341–359 (1905).
9. Brues, C. T.—Phoridæ. Genera Insectorum, 44th fasc. (1906).

EXPLANATION OF PLATE 22.

Ænigmatistes africanus, gen. et sp. nov.

Fig. 1. Dorsal view. × 45.
Fig. 2. Ventral view. × 45. *a*, Antenna; *b*, maxillary palp.
Fig. 3. Head in side view. × 85. *b*, Maxillary palp; *c*, eye; *d*, seta; *e*, lateral edge of pronotum.
Fig. 4. Antenna. × 250. *f*, First joint; *g*, second joint.
Fig. 5. Labrum, maxillary palpi, and hypopharynx. The parts have been separated and the left palpus is shown from the inner aspect. × 85. *ph*, Entrance to pharynx.

R. S. del. E. Wilson, lith & imp.

AENIGMATISTES AFRICANUS.

[*From "Novitates Zoologicae."* *Vol. XVI.* *December*, 1909.]

ON SOME OF THE AFRICAN LONGICORNS DESCRIBED BY HOPE AND WESTWOOD.

By K. JORDAN, Ph.D.

PROFESSOR E. B. POULTON kindly lent me the African Longicorns of the Hope Department for some time, so that I was enabled to compare them with the specimens in the collection of the Tring Museum and take notes on the types contained among the material of the Hope Department. I find that some of Hope's species have been wrongly identified by subsequent authors, myself included. It is especially his paper in *Ann. Nat. Hist.* 1843, p. 366, "On some New Insects from Western Africa," which has given rise to much uncertainty, owing partly to the shortness of the descriptions and partly to the erroneous place assigned to some of the insects. The following list gives all the Longicorns named in that paper.

1. Stenodontes downesi.

Mallodon downesii Hope, *l.c.* p. 366. n. 47 (1843) (Fernando Po ; Cape Palmas).

The well-known common Prionid. Hope mentions *Mallodon picipennis* and *raddoni* as being taken at Sierra Leone ; these are *nomina in coll.* of specimens of *downesi*, which varies a good deal.

2. Acanthophorus palini.

Acanthophorus palinii Hope, *l.c.* no. 48 (1843) (Sierra Leone).

This is the insect which Waterhouse figures in *Aid to the Identification of Insects*, p. 25, t. 167, fig. 1 (1888 ?).

3. Acanthophorus longipennis.

Acanthophorus longipennis Hope, *l.c.* no. 49 (1843) (Sierra Leone).
Acanthophorus megalops White, *Cat. Brit. Mus.* vii. p. 15 (1853) (Fernando Po).

Lameere, *Ann. Mus. Congo, Zool.* iii. *Longic.* (1903), treats the name as a synonym of *yolofus* Dalm. (1817). The type-specimen of the name (nymotype), however, which is a female, is very near to *megalops* White (1853), and in my opinion the same species. The puncturation is much more dispersed than in other *Acanthophorus* ; the femora are quite smooth ; the tibiae bear only scattered punctures and, in the lateral depression, a few setiferous granules. The apex is dorsally emarginate in all the tibiae, each angle of the sinus being produced into a tooth nearly as in *A. palini*. The antennal segments are not channelled.

4. Phyllarthrius africanus.

Phyllarthrius africanus Hope, *l.c.* no. 50 (1843) (Sierra Leone).

The antenna is described as having only ten segments. What Hope called the second segment is really the third, the second being quite short. The pronotum has a depression on each side, much as in *Ptycholaemus*. The elytra are cylindrical, nearly as in *Purpuricenus*, the apical margin of each being rounded. The black apical area of the elytra measures about 2 mm.

We have a female from Benito, Portuguese Cameroons, which agrees with the nymotype of *africanus*, but the apical area of the elytra is twice the size (about 4½ mm.) and the lobes of the antennal segments are narrower. I name this form

P. africanus benitensis subsp. nov.

5. Phyllarthrius unicolor.

Phyllarthrius unicolor Hope, *l.c.* p. 367. no. 51 (1843) (Ashanti)

I have not seen a second specimen of this species.

6. Phycholaemus signaticollis.

Hamaticherus signaticollis Hope, *l.c.* no. 52 (1843) (Cape Palmas).
Phycholaemus troberti Chevrolat, *Ann. Soc. Ent. France* p. 324. no. 5 (1858) (Guinea).

This species is the same as *troberti* Chevr.

7. Plocederus viridipennis.

Hamaticherus viridipennis Hope, *l.c.* no. 53 (1843) (Sierra Leone).

Antenna and legs yellowish tawny. Prothorax as in *P. chloropterus*, the transverse folds not quite so regular, the spine pointed. Elytra tawny, but this colour almost entirely suppressed by a blue-green gloss; puncturation more minute than in *chloropterus*; sutural angle with a short tooth, outer angle with a longer one. Abdomen tawny ochraceous.

8. Domitia pilosicollis.

Hamaticherus pilosicollis Hope, *l.c.* no. 54 (1843) (Cape Palmas).

This is not a Cerambycid, but a Lamiid. It belongs to *Domitia*, which is nearly allied to *Monochamus*, and is very near to *D. aenea* Parry (1849), the type of which I have not compared. *D. aenea* stands under *Sternotomis* in the Munich Catalogue.

9. Plocederus glabricollis.

Hamaticherus glabricollis Hope, *l.c.* no. 55 (1843) (Cape Palmas).

Legs and the first segment of the antenna tawny red, rest of antenna blackish tawny; knees black. Thorax smooth on disc, with some minute punctures and posteriorly two callosities; no spine on the side, but three callosities. Elytra green; puncturation minute and sparse; sutural angle with acute spine, outer angle pointed, but very little produced.

10. Ionthodes amabilis.

Ionthodes amabilis Hope, *l.c.* no. 56 (1843) (Sierra Leone).

The type-specimen seems to be somewhat discoloured. The elytra are blue with a velvety streak along the centre of each. The spots of the prothorax are white, while they are yellowish in our specimens from Sierra Leone.

11. Callichroma afrum.

Callichroma assimile Hope, *l.c.* no. 57 (1843) (Sierra Leone).

I consider this to be the same as *C. afrum* L. (1771).

12. Mecaspis laetum.

Callichroma laetum Hope, *l.c.* p. 368. no. 58 (1843) (Cape Palmas).

Greenish blue, or blue; antenna and legs black. No velvety pubescence on pronotum and elytra. *M. dives* Pascoe, *Tr. Ent. Soc. Lond.* p. 495 (1888), from Delagoa Bay, seems to be the same.

13. Mecaspis atripenne.

Callichroma atripenne Hope, *l.c.* no. 59 (1843) (Sierra Leone).

This is a well-known species, which cannot be confounded with any other *Mecaspis*.

14. Callichroma igneicolle.

Callichroma igneicolle Hope, *l.c.* no. 60 (1843) (Ashanti).
Callichroma imitator Jordan, *Nov. Zool.* i. p. 168. no. 86 (1894) (Gold Coast).

My *imitator* is the same as *igneicolle*. There are in collections several similar forms which have received names. They differ slightly from *igneicolle*, especially in the plication of the pronotum. Their distinctness is doubtful.

15. Oxyprosopus speciosus.

Cerambyx speciosus Dalman, in *Schoenh.*, *Syn. Ins.* i. 3. App. p. 153. no. 210 (1817) (Sierra Leone).
Promeces carbonarius Hope, *l.c.* no. 61 (1843) (Sierra Leone).

Bluish black, legs yellowish tawny. The only *Oxyprosopus* of this colour known to me.

16. Euporus amabilis.

Euporus amabilis Hope, *l.c.* no. 62 (1843) (Cape Palmas).

Anterior half of pronotum purplish blue like the occiput, without any punctures; disc of the dilated central part of the prothorax densely punctured, the puncturation more dispersed on the sides. Shoulders smooth, glossy, but the area between the shoulder and the scutellum as densely rugate as the rest of the elytrum.

17. Euporus strangulatus.

Euporus strangulatus Serville, *Ann. Soc. Ent. France*, p. 21 (1834) (East Indies ?).
Rhopalophora ? resplendens Newman, *Ent. Mag.* v. p. 496 (1838) (Fernando Po).
Euporus chrysocollis Hope, *l.c.* no. 63 (1843) (Fernando Po).

The puncturation of the thorax is very coarse; the anterior half of the pronotum is not quite smooth, there being some large punctures in the depression; the punctures on the disc of the wider part of the prothorax are centrally less numerous than at each side of the middle line, the smooth area penetrates mesially into the patch of punctures. There occurs a similar species in the same districts which has a broader prothorax, with the centre of the wider portion very densely punctured.

18. Sternotomis principalis.

Lamia principalis Dalman, in *Schoenh.*, *Syn. Ins.* i. 3. App. p. 162. no. 223 (1817) (Sierra Leone).
Sternodonta palini Hope, *l.c.* no. 64 (1843) (Sierra Leone).

In this form the spots in the posterior half of the elytra are green. We have several specimens from Sierra Leone. The individuals from Angola have all the

markings of the elytra buffish ochraceous; the pubescence between these markings is duller green than in the *principalis principalis*. This Angola form may be called

St. principalis hilaris subsp. nov.

19. Prosopocera princeps.

Sternodonta princeps Hope, *l.c.* p. 369, no. 65 (1843) (Ashanti).
Lamia (*Sternotomis?*) *princeps*, Westwood, *Arc. Ent.* ii. p. 125. t. 78. fig. 2 (1845) ; id., *l.c.* p. 147 (1845).

A very distinct species, easily recognised by the pattern of the elytra.

20. Sternotomis mirabilis forma amabilis.

Sternodonta amabilis Hope, *l.c*, no. 66 (1843) (Ashanti).
Sternotomis submaculata Kolbe, *Ent. Zeit. Stett.* p. 65. n. 31 (1893) (Togoland ; Ashanti) (1801).

Drury's *St. mirabilis* is dichromatic, nymotypical *mirabilis* being the green form and *amabilis* the tawny one.

The base of the pronotum in *amabilis* is green, as in *S. imperialis* F.; the elytra bear a green sutural spot as in *S. chrysopras*, but the suture is more or less extended green also in front of and behind this spot; sometimes the ochraceous markings are separated by more or less green interspaces. The structure by which the species can be most easily recognised is the basal tooth of the mandible of the male. This tooth, as Kolbe has already explained of *submaculata*, is curved inward, the tips of the two teeth pointing towards each other.

There appear to be several other species which have a tawny and a green form.

I add a note on another species of *Sternotomis*, described by Westwood :

Sternotomis virescens.

Sternotomis virescens Westwood, *Arc. Ent.* ii. p. 83. no. 1. t. 69. fig. 1 (1845) (Sierra Leone).
Sternotomis dubocagei Coquerel, *Ann. Soc. Ent. France*, p. 186. no. 3. t. 5. fig. 2 (1861) (Angola).
Sternotomis aglaura Kolbe, *Ent. Zeit. Stett.* p. 61. no. 30 (1894) (Uganda ; Cameroons).

The markings of worn specimens are much smaller and greener than those of fresh ones, which are chalky white or but slightly greenish. In the examples from Uganda the markings have sometimes an ochraceous tint.

Sternotomis gama Coquerel, *l.c.* no. 4. t. 5. fig. 4 (1861) (Angola) is based on a buffish individual of *virescens*, and *St. bohndorfi* Waterhouse, *Ann. Mag. N. H.* (5) xvii. p. 501 (1886) (Niam-Niam), also does not seem to be specifically different from *virescens*.

Die Fauna Südwest-Australiens.

Ergebnisse der Hamburger
südwest-australischen Forschungsreise 1905

herausgegeben von

Prof. Dr. W. Michaelsen und Dr. R. Hartmeyer.

Band II, Lieferung 9.

Blattidae

by

R. Shelford,
M. A., F. L. S.
(Oxford).

With Plate XIII.

Verlag von Gustav Fischer in Jena.
1909.

I am indebted to Dr. W. Michaelsen and Dr. R. Hartmeyer for the opportunity of examining the very interesting collection of *Blattidae* formed on the Hambourg expedition to S. W. Australia. All the specimens are preserved in alcohol, so that study of structural details is rendered more easy than is usually the case with dried specimens. The collection illustrates admirably the fact that Australia is the head-quarters of the apterous cockroaches belonging to the *Polyzosteria*-group of the subfamily *Blattinae*, no fewer than 27 species out of a total of 41 being of this section. There are only very few and scattered species of the *Polyzosteria*-group in extra-Australian regions, if we exclude the neotropical genera *Eurycotis* and *Pelmatosilpha*, which, though presenting one constant difference from *Polyzosteria* and its allies in the greater distance apart of the eyes, are nevertheless very closely allied to the Australian genera. Australia presents so many evidences of the great antiquity of its fauna that I should like to be able to assert with confidence that the *Polyzosteriae* constitute a very ancient group of cockroaches, but this I cannot conscientiously do. The geological evidence is directly opposed to the view that apterous *Blattidae* are more primitive than winged forms and the method of depositing the eggs in a chitinous capsule as do all the *Blattinae* cannot be regarded as other than a highly specialised habit; we can only say that it is probably a more primitive habit than is viviparity in thisgroup of *Orthoptera*. It is quite likely that the climatic conditions of Australia are in part responsible for the large proportion of apterous species of *Blattidae* in that continent; without being able to explain the reason it is nevertheless the fact that in desert regions or in regions where droughts are of long duration apterous species of *Blattidae* are more numerous than winged species, whilst in the moist jungles of West Africa and the Malay Archipelago the converse is true. The collection of Drs. Michaelsen and Hartmeyer illustrates this fact also, for of the 11 species not belonging to the apterous *Polyzosteria*-group, only 6 possess wings capable of flight, and of these 6 species 2 are importations from extra-Australian areas and 1 is winged in the male sex only. 11 of the species in the collection I regard as new to science. A few species are represented by immature forms only and these I have only

occasionally been able to determine; the indeterminable species are not included in the foregoing analysis but as some of the larvae belong to apterous species and some to winged species the general conclusions are not affected. Several of the species are represented by good series.

Subfam. Phyllodromiinae.

Genus *Phyllodromia* Serv.

Phyllodromia germanica (L.).

Blatta germanica LINNAEUS, Syst. Nat. (ed. XII) I, p. 668 (1767).

2 ♀ examples of this cosmopolitan species.

Stat. 65, Denham; Coll. Mus. Hamburg, Fremantle, W. WÖLTING leg. 1907.

Phyllodromia sp.

1 ♂ example in condition so poor that it is not advisable to describe it. Stat. 103, Guildford.

Phyllodromia liturata Tepp.

Phyllodromia liturata TEPPER, Tr. Roy. Soc. S. Australia, XIX, p. 150 (1895).

I refer to this species with some doubt 1 ♀ larva.

Previously recorded from Victoria.

Stat. 103, Guildford.

Genus *Allacta* Sauss. et Zehnt.

Allacta similis (Sauss.).

Blatta similis SAUSSURE, Mém. Soc. Sc. phys. nat. Genève, XX, p. 245 (1869).

Stat. 162, Torbay (1 ♂, 3 ♀).

Genus *Ceratinoptera* Br.

Ceratinoptera ensifera n. sp.

Plate XIII, Fig. 8, 15.

♂. Head testaceous, a band between the eyes, 6 spots on the face, and the labrum castaneous. Antennae longer than the body, testaceous in basal half, remainder fuscous. Pronotum trapezoidal, anteriorly not covering vertex of head, posteriorly truncate, disc castaneous with some testaceous maculae symmetrically arranged, bordered anteriorly and laterally with hyaline, the inner margin of the lateral border sinuate. Scutellum exposed, testaceous with two castaneous stripes. Tegmina lanceolate not extending beyond the 7th abdominal tergite, rufo-castaneous, mediastinal

area hyaline, a piceous humeral stripe; 12 costals, 5 longitudinal discoidal sectors, posterior ulnar a branch of the anterior ulnar, anal vein not clearly marked, its apex reaching a point at one-half of the total length of the tegmen. Wings minute, bent across the metanotum, so that their under-surface is uppermost, their apices overlapping, the posterior part not doubled under the anterior part; 3 irregular costals, median vein bifurcate at apex, ulnar vein obsolescent, 4 axillary veins, the first bifurcate. Abdomen above testaceous at base, remainder rufo-castaneous, laterally margined with testaceous; posterior angles of 9th tergite strongly produced backwards; supra-anal lamina transverse, posterior margin concave, posteriorly produced to form a flattened narrow process terminating in two diverging spines. Abdomen beneath rufous broadly bordered with testaceous, a few brown maculae in the testaceous border; subgenital lamina slightly asymmetrical, two styles. Cerci moderate, acuminate, 11-jointed, testaceous above, banded with fuscous beneath. Legs testaceous, anterior coxae spotted with fuscous. Front femora on anterior margin beneath with a complete row of spines, the more distal shorter than the proximal, 2 spines on posterior margin beneath. Mid- and hind-femora strongly armed with 6—7 spines on anterior margin, 4—5 on posterior margin beneath.

♀. As above but the testaceous maculae on disc of pronotum fused. Abdomen shorter and broader, piceous above and beneath (except at base) laterally margined with testaceous. Supra-anal lamina triangular, piceous with a testaceous spot at apex. Subgenital lamina semi-orbicular, ample. All the coxae spotted with fuscous.

Length of body (♂) 12 mm., (♀) 11.5 mm.; length of tegmina (♂) 7.8 mm., (♀) 7.6 mm.; pronotum (♂ and ♀) 3.8 mm. × 5 mm.

Stat. 129, Jarrahdale; Stat. 138, Lunenberg; Stat. 144, Bridgetown. (1 ♂, 2 ♀, 1 larva.)

Remarks. A very distinct and remarkable species.

The ootheca is chitinous, 6 mm. in length, is divided into 18 loculi and the suture is dentate. In the larva the thoracic tergites are testaceous with a few castaneous spots and broad lateral castaneous bands outwardly margined with hyaline.

Genus *Temnopteryx* Br.

Temnopteryx platysoma (Walk.).

Plate XIII, Fig. 1, 2.

Blatta platysoma Walker, Cat. Blatt. Brit. Mus., p. 111 (1868).

Walker's description is very inadequate, so I furnish a new diagnosis of the species.

♂, ♀. Testaceous. Vertex of head not covered by pronotum. Pronotum trapezoidal, lateral margins broadly hyaline, posteriorly truncate, exposing the scutellum, disc with two minute brown dots near the posterior margin, a slender castaneous line defining the inner borders of the lateral hyaline margins. Tegmina quadrate, not extending beyond the 1st abdominal tergite, sutural margins overlapping, outer angles rounded; 3 costals, 1 discoidal sector, anal vein not impressed, 2 axillaries, all the veins indistinct, their course marked by castaneous dots situated serially on either side of every vein. Wings absent. Meso- and metanotum with a few castaneous dots symmetrically arranged. Abdomen rufo-testaceous; supra-anal lamina (♂) shortly trigonal, (♀) triangular, apex notched; subgenital lamina (♂) triangular, cucullate, considerably exceeding the supra-anal lamina, apex deeply cleft, styles triangular, springing from the inner margins of the cleft in the lamina, (♀) semi-orbicular, ample. Margins of abdomen of ♀ beneath rufo-castaneous. Cerci moderate, 8-jointed. Legs moderately strongly spined; front femora with a row of piliform setae on the anterior margin beneath; mid- and hind-femora with 4—5 spines on both margins beneath.

Total length (♂) 7 mm., (♀)7.5 mm.; length of tegmina 3 mm.; pronotum 2.5 mm. $\times$ 3.2 mm.

The ootheca is chitinous and carried with the suture uppermost.

(Several examples of both sexes.)

Stat. 115, North Fremantle; Stat. 146, Boyanup; Stat. 162, Torbay.

Remarks. 1 ♂ and 1 ♀ from the first of the above localities were found in the nest of a spider of the genus *Phryganoporus*; this symbiotic association is very remarkable; these specimens are more heavily marked than the rest. The systematic position of this species is a little doubtful, for it presents great similarity to some species of *Hololampra (Ectobiinae)*; the differences separating the two subfamilies *Ectobiinae* and *Phyllodromiinae* are very slight and elusive but for the present at any rate I think that *Hololampra* should be limited to those small species of *Blattidae* with reduced tegmina, with the supra-anal lamina transverse in both sexes and with the mid- and hind-femora very sparsely armed[1]). The species *T. ectobioides* mihi and *T. affinis* mihi from E. Africa present many features of resemblance to this Australian species.

---

1) The inclusion of *T. platysoma* in the genus *Ceratinoptera* by me (Gen. Insect. Blattidae, Phyllodromiinae, Fasc. 73) is due to a slip.

Genus *Loboptera* Br.

Loboptera circumcincta Tepp.

L. circumcincta TEPPER, Tr. Roy. Soc. S. Australia, XVII, p. 37 (1893).

Stat. 65, Denham; Stat. 67, Dirk Hartog, Brown Station; Stat. 72, Northampton; Stat. 94, Coolgardie; Stat. 99, Lion Mill; Stat. 103, Guildford; Stat. 118, Fremantle; Stat. 152, Gooseberry Hill; Stat. 155, York. (14 ♀.)

Loboptera duodecimsignata Tepp.

L. duodecimsignata TEPPER, l. c. p. 36 (1893).

Stat. 99, Lion Mill; Stat. 109, Subiaco; Stat. 112, Karrakatta; Stat. 114, Buckland Hill; Stat. 119, Fremantle, Obeliskhügel. (7 ♀, 1 larva.)

Remark. The males of these two species must be extremely rare, as they have never been discovered, though the females are common enough.

Subfam. Epilamprinae.

Genus *Epilampra* Burm.

Epilampra sp.

3 larvae that I am not able to determine with any greater degree of accuracy.

Stat. 65, Denham; Stat. 88, Moora; Stat. 145, Donnybrook.

Subfam. Blattinae.

Genus *Polyzosteria* Burm.

Polyzosteria cuprea Sauss.

Polyzosteria cuprea SAUSSURE, Mém. Soc. Sci. phys. nat. Genève, XVII, p. 133, pl. 1, f. 2 (1864).

Stat. 165, Albany; Stat. 167, South Albany. (1 ♂, 1 ♀.)

Polyzosteria pubescens Tepp.

Polyzosteria pubescens TEPPER, Tr. Roy. Soc. S. Australia, XVII, p. 75 (1893).

Stat. 91, Mount Robinson near Kalgoorlie (1 ♀).

Polyzosteria subverrucosa (White).

Blatta subverrucosa WHITE, in: GREY, Journ. Exped. Australia, II, p. 467 (1841).

Coll. Mus. Hamburg, Hill country of Upper Blackwood district; J. WHISTLER leg. (1 ♀.)

Polyzosteria Mitchellii (Angas).

Blatta Mitchellii Angas, S. Australia Illustr., pl. 48, f. 1 (1847).

Coll. Mus. Hamburg, Fremantle; W. Wölting leg. 1907 (1 ♀).

Genus *Platyzosteria* Br.

Platyzosteria ruficeps n. sp.

Plate XIII, Fig. 3.

♂. Piceous, nitid, impunctate. Vertex of head orange-rufous, antennae flavid. Coxae, femora, cerci, supra-anal and subgenital laminae rufo-castaneous. Tegminal rudiments absent. Supra-anal lamina subquadrate, angles rounded, posteriorly emarginate, margins serrate, slightly exceeded by the cerci. Lateral margins of 7th abdominal tergite not serrate, its posterior margin sinuate. Subgenital lamina subquadrate, posterior margin slightly sinuate and finely dentate. Coxae bordered with pale testaceous. Tibiae and tarsi piceous. Length 24 mm.; pronotum 6.1 mm. $\times$ 10.1 mm.

Stat. 88, Moora (1 ♂).

Remark. The only species of the genus with rufous vertex.

Platyzosteria invisa (Walk.).

Periplaneta invisa Walker, Cat. Blatt. Brit. Mus., p. 137 (1868).

Stat. 75, Geraldton; Stat. 158, Broome Hill; Coll. Mus. Perth, ?Murchison district (hab. doubtful!).

Platyzosteria atrata (Er.).

Periplancta atrata Erichson, Arch. Naturg., VIII, p. 248 (1842).

Stat. 95, Boorabbin (2 ♂).

Remark. The continental forms of this species frequently have the thoracic tergites margined with rufous and the tibiae partly rufo-castaneous.

Platyzosteria consobrina (Sauss.).

Polyzosteria consobrina Saussure, Rev. Zool., (2) XVI, p. 306 (1864).

Stat. 120, Fremantle, Haus und Garten (1 ♂).

Remark. The type of this species has been lost and it cannot now be recognised with absolute certaintly: it may possibly be a larval form of *P. invisa* Walk.

Platyzosteria armata Tepp.

Platyzosteria armata TEPPER, Tr. Roy. Soc. S. Australia, XVII, p. 84 (1893).

Stat. 91, Mount Robinson near Kalgoorlie; Stat. 94, Coolgardie. (5 ♂, 2 ♀.)

Platyzosteria curiosa n. sp.

Plate XIII, Fig. 11, 12.

♀. Piceous, nitid, minutely punctate. Vertex and lateral margins of thorax castaneous. Tegminal rudiments semi-articulated. Posterior angles of 7th abdominal tergite strongly produced. Supra-anal lamina much produced, not cucullate, semi-oval, apex not emarginate, margins inconspicuously serrate, exceeded by the cerci which are rather long.

The suture separating the subgenital valves from 6th abdominal sternite not transverse but V-shaped, the valves themselves not apposed but separated at their apices and depressed. Legs piceous, coxae not margined with testaceous. Length 19 mm.; pronotum 5 mm. × 7 mm.

Stat. 97, Northam (1 ♀).

Remarks. It is possible that this example is not quite mature, but even if this is the case the species is highly remarkable for the structure of the terminal sternites; the backward process of the central part of the 6th sternite seems to preclude the possibility of the complete apposition of the genital valves. A second specimen in the Oxford Museum I refer to this species with some doubt, for though the structure of the apex of the abdomen is the same as in the type example, the legs are rufo-castaneous and the cerci are shorter than the supra-anal lamina. The arrangement of the terminal abdominal sternites in a typical Blattine nymph is shown in Plate XIII, Fig. 13, and a comparison of this with Fig. 11 will show at a glance the peculiarity of *P. curiosa* in this respect.

Platyzosteria scabriuscula Tepp.

Periplaneta scabriuscula TEPPER, Tr. Roy. Soc. S. Australia, XVII, p. 108 (1893).

Stat. 88, Moora; Stat. 98, Wooroloo; Stat. 99, Lion Mill; Stat. 109, Subiaco; Stat. 139, Brunswick; Stat. 144, Bridgetown; Stat. 145, Donnybrook; Stat. 154, Pickering Brook; Stat. 160, Cranbrook. (Several examples of both sexes.)

Platyzosteria obscura (Tepp.).

Periplaneta obscura TEPPER, Op. cit., p. 374 (1893).

With some doubt I refer two examples to this species, which may be re-defined as follows:

♂. Piceous, nitid, except for a few faint punctures on the distal tergites. Antennae fuscous. Tegminal rudiments present, not quite

Platyzosteria semivitta (Walk.).

Periplaneta semivitta WALKER, Cat. Blatt. Brit. Mus., p. 143 (1868).

Stat. 103, Guildford; Stat. 113, Cottesloe; Stat. 116, East Fremantle, Recreation Ground; Stat. 136, Harvey; Stat. 146, Boyanup; Stat. 154, Pickering Brook. (5 ♂, 5 ♀.)

Platyzosteria Hartmeyeri n. sp.

♂. Piceous, nitid, impunctate. Antennae fuscous, paler at base. Pronotum all round, lateral and posterior margins of metanotum, and posterior margins of mesonotum and of abdominal tergites and sternites pale olivaceous-yellow. Tegminal rudiments present, narrow and semi-articulated. Supra-anal lamina subquadrate, scabrous, apex truncate and slightly emarginate, margins serrate. Cerci short and broad, barely exceeding the lamina. Subgenital lamina subquadrate, a small tooth at the base of each style. Coxae bordered with testaceous, legs rufo-castaneous.

Length 12 mm.; pronotum 4 mm. $\times$ 5 mm.

Stat. 95, Boorabbin (1 ♂, 1 larva).

Remark. The species is very distinct on account of its colouration.

Genus *Cutilia* Stål.

Cutilia heydeniana (Sauss.).

Periplaneta heydeniana SAUSSURE, Rev. Zool., (2) XVI, p. 317 (1864).

Stat. 165, Albany (1 ♂, 1 ♀).

Genus *Zonioploca* Stål.

Zonioploca medilinea (Tepp.).

Knephasia medilinea TEPPER, Tr. Roy. Soc. S. Australia, XVII, p. 99 (1893).

Stat. 91, Mount Robinson near Kalgoorlie (3 ♀).

Zonioploca pallida n. sp.

Plate XIII, Fig. 7.

Flavo-testaceous. Vertex and frons finely punctate; antennae, except at base, infuscated. Dorsal surface finely granulate, the granules rufous. Abdominal stigmata distinct. A piceous streak along the anterior margins of the meso- and metanotum (generally concealed in dried specimens). Cerci castaneous except at their extreme tips which are testaceous. Legs testaceous, the spines castaneous, tibiae on their dorsal aspects castaneous. Supra-anal lamina (♂) subquadrate, angles obtuse, posteriorly emarginate, exceeded by the cerci; (♀) triangular, apex emarginate, barely exceeded by the cerci. Subgenital lamina (♂) quadrate, angles acute, posterior margin

concave, styles lateral, acute. Length 20—24 mm.; pronotum 6—7 mm. X 9—10 mm.

Stat. 84, Dongarra; Stat. 99, Lion Mill; Stat. 121, Rottnest; Stat. 137, Collie; Stat. 139, Brunswick; Stat. 145, Donnybrook; Stat. 146, Boyanup; Stat. 148, Busselton; Stat. 154, Pickering Brook. (5 ♂, 5 ♀.)

The types (ex coll. WILSON SAUNDERS) are in the Oxford Museum; they are labelled Swan River.

Genus *Anamesia* Tepp.

Anamesia polyzona (Walk.).

Plate XIII, Fig. 10.

Polyzosteria polyzona WALKER, Cat. Blatt. Brit. Mus., p. 159 (1868).

Stat. 67, Dirk Hartog, Brown Station; Stat. 80, Eradu; Coll. Mus. Hamburg, Fremantle; W. WÖLTING leg. 1907. (4 ♂, 5 ♀.)

Anamesia Frenchii Tepp.

Anamesia Frenchii TEPPER, Tr. Roy. Soc. S. Australia, XVII, p. 72 (1893).

Stat. 76, Day Dawn; Stat. 80, Eradu. (2 ♂.)

Remark. The species varies considerably, in some specimens the pale borders of the tergites are broad, in others narrow, and the legs vary in colour from castaneous to testaceous.

Genus *Desmozosteria* nov.

Allied to *Zonioploca* STÅL, but the angles of none of the abdominal tergites backwardly produced. Lateral margins of the pronotum incrassated. Tegminal rudiments absent. Dorsal surface punctate or smooth. Supra-anal lamina (♂) quadrate, margins entire, (♀) trigonal, cucullate. Cerci short, flattened. Posterior metatarsus very short, not spined beneath.

This genus stands in the same relation to *Zonioploca* that *Anamesia* does to *Cosmozosteria*.

Desmozosteria Michaelseni n. sp.

Plate XIII, Fig. 9.

♀. Above olivaceous-green. Disc of thoracic tergites flavo-testaceous with a few castaneous maculae. Abdominal tergites with anterior half paler than posterior half, a narrow piceous line between, some piceous spots situated laterally in the pale bands, 7th tergite and supra-anal lamina piceous. Head piceous to castaneous, laterally paler. Antennae rufous at base, remainder fuscous. Abdominal sternites olivaceous, valvules and some markings on penultimate sternite piceous. Cerci orange. Legs rufo-testaceous, tibiae

above castaneous. Lateral margins of pronotum slightly but distinctly incrassated. Thoracic tergites finely and indistinctly punctate. Supra-anal lamina trigonal, margins entire, apex slightly emarginate. Cerci of equal length with lamina, flattened. Length 22 mm., pronotum 7 mm. × 10.2 mm.

Stat. 95, Boorabbin (1 ♀).

Remark. *Pseudolampra punctata* Tepp. may be allied to this species, but I am quite unable to fix the systematic position of the genus *Pseudolampra* from the description.

Desmozosteria rufescens n. sp.

♂. Above varying from rufous to rufo-testaceous, posterior margins of all the tergites narrowly testaceous. Dorsal surface with large shallow punctures, these absent from the middle of the discs of the meso-, metanotum and abdominal tergites 1—5 and from the terminal abdominal tergites. Lateral margins of thoracic tergites distinctly incrassated. Antennae, except for basal joint, fuscous. Head, body beneath and legs testaceous. Scent-gland opening visible on 1st abdominal tergite. Supra-anal lamina quadrate, posterior angles acute, lateral margins entire, apex widely emarginate. Cerci shorter than the lamina, testaceous. Subgenital lamina quadrate, apex widely emarginate, styles lateral, long. Length 25 mm.; pronotum 7 mm. × 10 mm.

Stat. 65, Denham (2 ♂).

Genus *Stylopyga* Fisch.

Stylopyga Michaelseni n. sp.

♂ and ♀. Castaneous. Head piceous, mouth-parts testaceous. Entirely apterous. Thoracic tergites smooth, nitid, abdominal tergites minutely scabrous. Posterior angles of the ante-penultimate and penultimate abdominal tergites backwardly produced. Supra-anal lamina (♂) subquadrate, posterior angles rounded, posteriorly widely emarginate, slightly hirsute, (♀) triangular, apex notched. Subgenital lamina (♂) subquadrate, posteriorly slightly emarginate, styles stout, acuminate. Cerci short and broad, barely exceeding the supra-anal lamina of the female, 9-jointed. Legs rufo-castaneous, coxae outwardly margined with testaceous. Posterior metatarsus barely longer than succeeding joints, biseriately spined beneath, its pulvillus apical, and with a spine on each side; second and third joints not spined beneath, their pulvilli occupying their entire length and with a spine on each side. No tarsal arolia. Length ♂ 18 mm., ♀ 16.5 mm.; pronotum ♂ 4 mm. × 5 mm., ♀ 4.5 mm. × 5.1 mm.

Stat. 95, Boorabbin (2 ♂, 2 ♀).

Remark. The tarsal structure resembles that in the genus *Cutilia* and the species may be regarded as intermediate between that genus and *Stylopyga*; the absence of tarsal arolia is characteristic of a good many species of *Stylopyga*.

Genus *Periplaneta* Burm.

Periplaneta americana (L.).

Blatta americana LINNAEUS, Syst. Nat. (ed. X), I, p. 424 (1758).

Stat. 65, Denham (1 ♂, 1 ♀).

Subfam. Oxyhaloinae.

Genus *Ectoneura* Shelf.

Ectoneura margarita (Tepp.).

Ectobia (?) margarita TEPPER, Tr. Roy. Soc. S. Australia, XIX, p. 147 (1895).
Ectoneura figurata SHELFORD, Ann. Mag. Nat. Hist., ser. 7, XIX, p. 43 (1907).

Stat. 95, Boorabbin (1 ♂).

Remark. The species is possibly synonymous with the *Blatta marcida* of ERICHSON.

Subfam. Panchlorinae.

Genus *Oniscosoma* Br.

Oniscosoma granicollis (Sauss.).

Zetobora granicollis SAUSSURE, Rev. Zool., (2) XIV, p. 232 (1862).

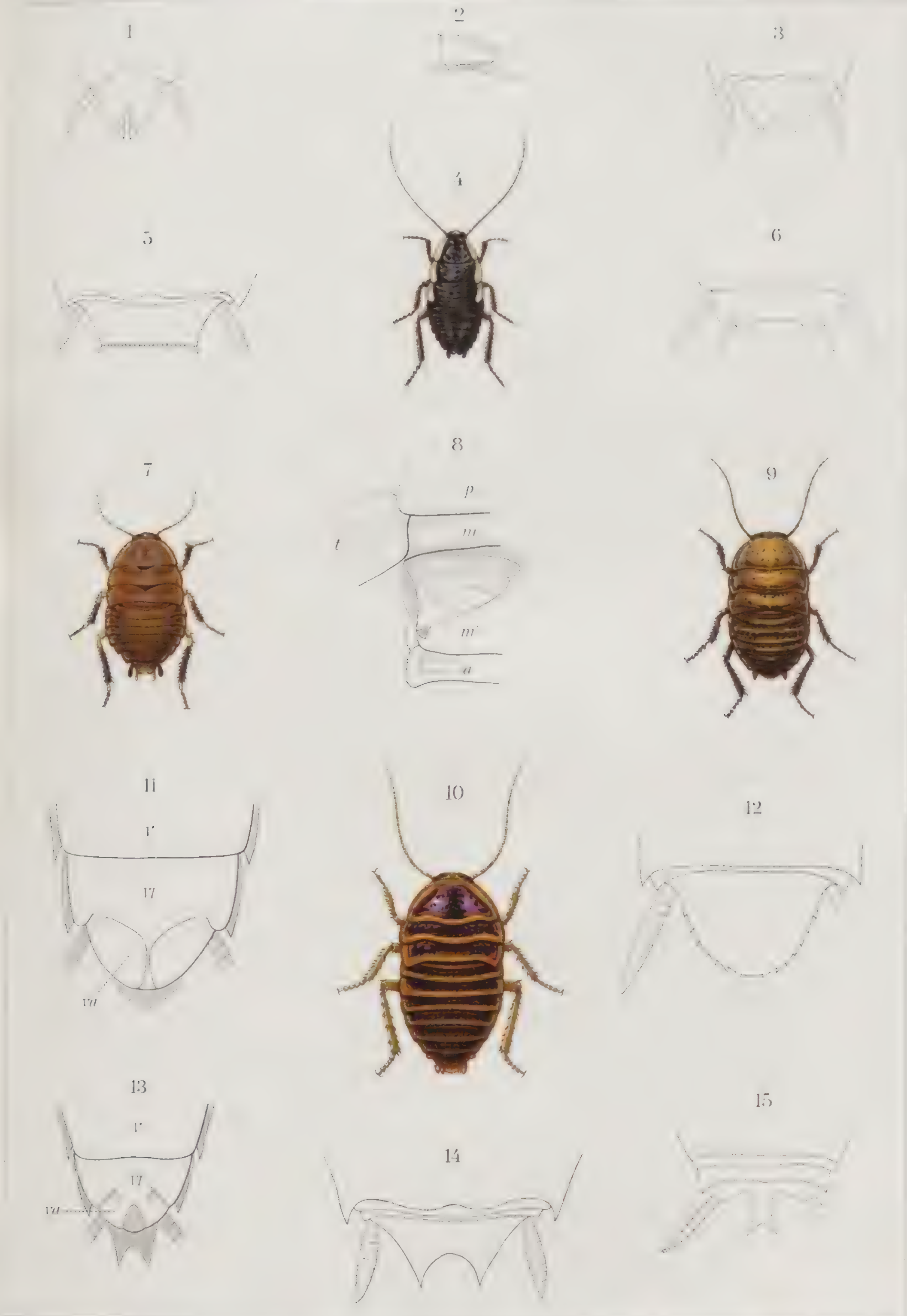
Stat. 103, Guildford; Stat. 109, Subiaco, North; Stat. 116, East Fremantle, Recreation Ground; Stat. 146, Boyanup; Coll. Mus. Hamburg, Hill country of Upper Blackwood district; J. M. WHISTLER leg.; Stat. 162, Torbay. (A large number of specimens of both sexes and at all stages of growth.)

Remark. The larval males closely resemble the females.

Explanation of Figures.

Plate XIII.

Fig. 1. *Temnopteryx platysoma* Walk. Subgenital lamina of ♂.
Fig. 2. „ „ „ Subgenital lamina of ♂ from the side (ventral surface uppermost).
Fig. 3. *Platyzosteria ruficeps* n. sp. Apex of abdomen of ♂ from above.
Fig. 4. *Platyzosteria inclusa* Walk. The whole animal, natural size.
Fig. 5. *Platyzosteria conjuncta* n. sp. Apex of abdomen of ♂ from above.
Fig. 6. „ „ n. sp. Apex of abdomen of ♂ from below.
Fig. 7. *Zonioploca pallida* n. sp. The whole animal, natural size.
Fig. 8. *Ceratinoptera ensifera* n. sp. Thorax from above.
p. pronotum, *m.* mesonotum, *m'* metanotum, *a.* first abdominal tergite, *t.* tegmen.
Fig. 9. *Desmozosteria Michaelseni* n. sp. The whole animal, natural size.
Fig. 10. *Anamesia polyzona* Walk. The whole animal, natural size.
Fig. 11. *Platyzosteria curiosa* n. sp. Apex of abdomen of ♀ from below.
V. 5th abdominal sternite, *VI.* 6th abdominal sternite, *va.* genital valves.
Fig. 12. *Platyzosteria curiosa* n. sp. Apex of abdomen of ♀ from above.
Fig. 13. *Platyzosteria obscuripes* Tepp. Apex of abdomen of ♀ nymph from below, for comparison with Fig. 11.
Fig. 14. *Platyzosteria variegata* n. sp. Apex of abdomen of ♂ from above.
Fig. 15. *Ceratinoptera ensifera* n. sp. Apex of abdomen of ♂ from above.



Shelford gez., Stender gem.

Verlag von Gustav Fischer in Jena

22

[*Extracted from the* LINNEAN SOCIETY'S JOURNAL—ZOOLOGY, vol. xxx. *June* 1910.

ON A COLLECTION OF BLATTIDÆ PRESERVED IN AMBER, FROM PRUSSIA.

BY

R. SHELFORD, M.A., F.Z.S.,

On a Collection of Blattidæ preserved in Amber, from Prussia.

By R. Shelford, M.A., F.L.S.

(Plates 47 & 48.)

[Read 16th December, 1909.]

In 1907 Dr. R. Klebs, of Königsberg-i.-Pr., sent to me for study the major part of his fine collection of Blattidæ enclosed in amber, and this spring I received from him the remainder. As practically nothing has been written on the Blattidæ of the amber-deposits since the appearance of the great memoir "Die im Bernstein befindlichen Hemipteren und Orthopteren der Vorwelt" * by Germar and Berendt in 1856, and as only 5 species of Blattidæ were described in that work, it is not surprising that a study of Dr. Klebs's large collection of these insects enables me to add considerably to our knowledge of the fauna that flourished in the Oligocene forests of East Prussia. I am greatly indebted to my kind correspondent for the opportunity he has afforded me of examining a collection unequalled in interest and wealth of material.

All the specimens come from the well-known amber-deposits in the Baltic provinces of East Prussia; the deposits are of Lower Oligocene age and correspond to the Headon beds in the Isle of Wight. As has long been recognised, the insect-fauna of the amber-deposits differs in no very striking features from a characteristic tropical or subtropical fauna of the present day, and the Blattidæ which I have examined, belonging to 9 genera and 24 species, present no details of structure or form which we can regard as peculiarly primitive and archaic. I have not found it necessary to erect a single new genus for the reception of any amber-enclosed species, for all are plainly referable to genera which flourish to-day in the tropical belt. The chief interest of the collection lies in the comparison which it is possible to make between the occurrence of certain genera in the amber-deposits and their geographical distribution at the present time. The following are the genera of Blattidæ occurring in the amber-deposits :—

Ectobius.
Ischnoptera.
Phyllodromia.
Ceratinoptera.
Temnopteryx.
? *Nyctibora* (larval form only).
Periplaneta.
? *Polyphaga* (larval form only).
Holocompsa.

* This is Bd. ii. Abt. 1 of the memoir 'Organische Reste im Bernstein,' the first volume having appeared in 1845.

Of these genera, *Ectobius* at the present day is confined to Europe and tropical Africa *; *Ischnoptera*, *Phyllodromia*, *Ceratinoptera*, and *Temnopteryx* occur in all the tropical regions, in Australia, and in the southern half of the Nearctic region; *Nyctibora* is a characteristic Neotropical genus; *Periplaneta*, if we exclude the cosmopolitan species distributed by the agency of man, is a tropical and subtropical genus; *Polyphaga* is found in the southern and extreme eastern parts of the Palæarctic region, in Africa, and sporadically in the Oriental region; *Holocompsa* is Neotropical, Ethiopian, and Oriental in its distribution. It must be remembered that the species of cockroaches preserved in amber are, with one exception, of small or moderate dimensions; there are none rivalling in size the species of *Blabera* from S. America, or of *Nauphoëta* from tropical Africa. Large robust species if entrapped in the sticky resin exuding from the trees of the Oligocene forest would be able to break away and escape the doom that awaited more fragile species. That species of considerable size did exist side by side with smaller forms is indicated by the presence in Dr. Klebs's collection of a large larval moult which I refer with some little doubt to the genus *Nyctibora*; judging from the general appearance of this specimen, I do not consider it to be a final moult, and there is every reason to suppose that the adult was not inferior in size to modern representatives of the genus. There can be little doubt that if the larger species of the amber fauna had been preserved they would have supplied additional evidence of its affinities with a modern tropical fauna.

A comparison of the amber-enclosed Blattidæ with the paucity of species occurring in Northern Europe at the present day is sufficiently indicative of the profound change of climate that has ensued within geologically-recent times. Of the 9 genera found in the amber fauna, only one † has persisted in N. Europe to the present day; and that one is *Ectobius*, represented in the amber fauna by two species, in modern times by three N. European forms. At one time I was inclined to regard the two Oligocene species as a purely Palæarctic element in a tropical fauna and was puzzled to find a reasonable explanation of their presence. But since then I have examined a good many collections of Blattidæ from tropical Africa and there is no doubt that the genus *Ectobius* is well represented on that continent, though all but one of the species are undescribed. It is clear, then, that *Ectobius* is not purely a genus of temperate or subarctic regions and its presence in the amber fauna is not a matter for very great surprise. At the same time the two species of the amber fauna appear to be more closely related to the well-known

* I have recently had the opportunity of examining the types or co-types of species from Australia and New Zealand which have been referred to *Ectobius*; not one of these belongs even to the subfamily *Ectobiinæ*.

† *Phyllodromia germanica* is not included; it is a cosmopolitan species whose centre of dispersal is not known.

Ectobius lapponicus than to any other recent member of the genus, and it is tempting to suppose that the modern species is a direct descendant of one of the amber-enclosed forms. If this is so, we may perhaps continue our speculations and assume that whilst the onset of more rigorous conditions of climate eventually drove southwards the great bulk of the cockroaches of the amber fauna, two species of *Ectobius* held their ground and one of these has persisted with subsequent small modifications of structure until the present day. That the climate of N. Europe during the Glacial Epoch was of such severity that animal life was rendered impossible is, in the light of modern researches, extremely unlikely *, and there is nothing inherently improbable in the view that an insect could persist in one area from Oligocene to recent times with only slight changes in structure.

The unique specimen which I refer to the genus *Holocompsa* is most nearly allied to *H. minutissima*, de Geer, originally described from Surinam; but this and the two *Ectobii* are the only species which I can compare with any confidence with modern species, and in view of the almost world-wide distribution of the genera represented in the amber-deposits by adult forms it would be most hazardous to attempt to compare this fauna with any particular tropical fauna of to-day. Yet if I am right in determining a single damaged moult as belonging to a species of *Nyctibora*, we have, in conjunction with the undoubted affinities of the single species of *Holocompsa*, slight indications of a remote connection between the modern Neotropical fauna and the amber fauna, for the entire subfamily *Nyctiborinæ* is now confined to the Neotropical region of the world.

A few remarks may be made on the condition of the specimens which I have handled. The great majority are in a most admirable state of preservation and with a high-power simple lens it is generally possible to make out nearly all the details of their structure without great difficulty. When I reflect on the enormous antiquity of these absolutely perfect specimens I cannot refrain from expressing a hope that some method will shortly be devised for enshrining in a similar way in balsam or other resin the type-specimens of recent species of insects. As the science of entomology advances the importance of the type-specimen ever increases; unfortunately the ravages of mites, *Anthreni*, dust, mould, and careless students are often disastrous, and we bemoan to-day the irreparable loss of specimens that would afford valuable clues to hopeless tangles of synonymy. It is sad, but none the less true, that it is possible to make out more of the external anatomy of the Oligocene *Ectobius balticus* from an examination of specimens many thousands of years old, than of the recent *Ectobius lapponicus* from an examination of Linnæus's type, the shattered wreck of which is preserved in the cabinets of this Society.

* *Cf.* Scharff: 'The History of the European Fauna,' 1899.

Some of the amber-enclosed specimens are coated with an opaque whitish deposit, due probably to a mixture of body-juices or of water with the resin in contact with the enclosed insect's body. A few of the insects struggled violently when first entrapped, as shown by the wavy and disturbed appearance of the amber, and this obscures the structural details which it is important for classification's sake to make out.

I have not figured many of the species *in toto*, as I do not consider such illustrations of very great value. The species of *Phyllodromia* and *Ischnoptera*, both fossil and recent, present such a uniform appearance that a careful examination of details of wing and tegminal venation, of leg-armature, and of the form of the terminal abdominal segments is necessary to discriminate between the numerous forms; it is these details that I have figured wherever necessary.

I have succeeded in identifying all the species described by Germar and Berendt, but not those few described by authors who wrote before 1856, and I do not know where the types of these species are preserved.

Handlirsch in 'Die Fossilen Insekten,' 1906–1908, pp. 694–695, gives a complete list of all the species described from amber-*inclusa*, with references to the literature.

The numbers quoted under each species are those which Dr. Klebs's specimens bear; a glance at them indicates the relative abundance of the species. Numbers in italics signify type-specimens.

Subfam. ECTOBIINÆ.

ECTOBIUS BALTICUS, *Germ. & Ber.* (Pl. **47**. fig. 1.)

Blatta baltica, Germar & Berendt, Organ. Reste im Bernstein, Bd. ii. Abt. 1, p. 34, pl. 4. fig. 5 (1856).

♂♂. Nos. 5428, 5429, 5436, 5439, 5465, 5468, 5470, 5474, 5480, 5487, 5493, 5496, 5503, 5513, 5521, 5527, 5542, 5554, 5556, 6705, 6723, 6726, 6734, 7478, α 1.

♀♀. Nos. 5440, 5457, 5475, 5557, 5560, 6719.

The species resembles *E. lapponicus*, Linn., in its coloration, the venation of the tegmina, and the form of the apex of the abdomen. It is distinguished by its smaller size, by the long tegmina and wings of the female, and by the short acuminate genital style of the male. The single genital style in *E. lapponicus* is broad and rounded, and a microscopical examination shows that its apex is furnished on the dorsal side with a tuft of hairs; in *E. balticus* the style is like a small pin-point. Three undoubted female examples show that *E. balticus* differs from all the modern European species in the greater length of the tegmina and wings, these slightly surpassing the apex of the

abdomen. The subgenital lamina of the female is semiorbicular, ample, and with the posterior margin slightly sinuate.

A slight variation in the coloration of the pronotum is exhibited by some specimens (Nos. 5428, 5436, 5474, 5503); in these the disc of the pronotum is divided by a pale central line, which at the base divides into two, and two short lines may or may not be given off from the limbs of the bifurcation. In No. 5436 the "titillator penis" is extended, its shape is as in *E. lapponicus*. The species average 9 mm. in length; the females are slightly shorter and broader than the males.

ECTOBIUS INCLUSUS, sp. n. (Pl. **47**. fig. 2.)

♂ ♂. Nos. *5469*, 5531 (adults), 5530 (larva).
♀ ♀. Nos. *5437*, 5543.

Allied to *E. balticus*, Germ. & Ber., but the disc of the pronotum testaceous, with numerous castaneous dots (? punctures) and lines more or less symmetrically arranged. Sub-genital lamina (♂) rather more elongate and furnished with one long and sharply pointed style. ♀. Shorter and broader, with tegmina and wings exceeding apex of abdomen; sub-genital lamina semi-orbicular, ample, posterior margin sinuate. Femora very sparsely armed.

Total length (♂) 9 mm.; (♀) 8·8 mm.

In No. 5437 the tegmina are slightly parted, revealing the apex of the wing, the venation of which, so far as it can be seen, conforms to the arrangement characteristic of the genus. In the larva (No. 5530) the posterior angles of the meso- and metanotum are backwardly produced, as in all Blattid larvæ of winged species. The genital style of the male is highly characteristic of the species.

Subfam. PHYLLODROMIINÆ.

ISCHNOPTERA GEDANENSIS, *Germ. & Ber.* (Pl. **47**. fig. 3.)

Ischnoptera gedanensis, Germar & Berendt, t. c. p. 33, pl. 4. fig. 4 (1856).

♂ ♂. Nos. 5455, 5462, 5484, 5562, 6702, 6706, 6709, 6715, 6717, 6722, *x*4.
♀. No. 6712.

Since the wings are completely concealed in all the examples which have been examined, it is impossible to be absolutely certain if this species really belongs to the genus *Ischnoptera*; but as the insect in its general facies bears a very close resemblance to certain modern species of *Ischnoptera*, I refer the fossil form to that genus without much hesitation. The published description of the species is fairly complete and the following details only need to be added to it:—Tegmina with mediastinal vein simple or with one short branch, radial vein bifurcate and ramose at apex, 15–17 costals, 9–10 longitudinal discoidal sectors connected with each other by numerous transverse

venulæ. Anal field rather elongate and narrow, anal vein near its apex curved sharply inwards to the sutural margin. Front femora on anterior margin beneath with 4–5 stout spines, succeeded distally by numerous closer set and smaller spines; two spines on the posterior margin near the apex. Mid- and hind-femora with 4–5 long spines on both margins beneath. Genicular spines long. Formula of apical spines $\frac{1}{1}, \frac{1}{1}, \frac{1}{1}$. Sub-genital lamina almost symmetrical, posterior margin bisinuate; the styles short, situated in the sinuations. Cerci moderate, with 9 visible joints.

♀. Similar to ♂, but shorter and rather more robust; sub-genital lamina semi-orbicular, ample. Total length (♂ & ♀) 18 mm.

One example (6722) is a mere fragment, only the pronotum, tegmina, wings, and one leg remaining, the rest having probably been devoured by some predaceous insect.

Ischnoptera klebsi, sp. n. (Pl. **47**. fig. 4.)

♂ ♂. Nos. *5450*, 5481, 6701.

♂. Allied to *I. gedanensis*, Germ. & Ber. Antennæ considerably longer than the body and tegmina. Eyes rather wide apart. Pronotum trapezoidal, anteriorly subtruncate, freely exposing the vertex of the head, posteriorly most obtusely angled, sides deflexed, disc with two oblique and shallow impressions. Tegmina and wings exceeding the apex of the abdomen. Venation of tegmina and armature of femora as in *I. gedanensis*. Sub-genital lamina hirsute, almost symmetrical, and with a pair of stout, short hirsute styles, placed close together near the middle, the right style a little stouter than the left and with some strong short setæ near its apex. Cerci 10-jointed, sub-fusiform, not surpassing the apex of the tegmina.

Total length 18 mm.

This species is undoubtedly very close to *I. gedanensis*, but the different form of the sub-genital lamina and styles serves to distinguish it.

Ischnoptera perplexa, sp. n. (Pl. **47**. fig. 5.)

♂ ♂. Nos. *5473*, 5491. ♀. No. *5477*.

♂. Closely allied to the two preceding species, but smaller than either. Sub-genital lamina as in *I. klebsi*, but more hirsute, and the styles shorter, their dorsal surface furnished with very stout setæ.

♀. Similar to ♂; sub-genital lamina ample, semi-orbicular; cerci stouter; tegmina shorter.

Total length (♂) 14·5–15·8 mm.; (♀) 13–15·8 mm.

It is very difficult to separate these three closely allied species from one another from an examination of the tegminal venation and ventral surface

alone; it is more than likely that important differences are presented by the secondary sexual characters, such as gland-openings, occurring on the dorsal surface, and by the form of the supra-anal lamina; but since these are not visible in the specimens before me I have relied on the slight differences in the form of the sub-genital laminæ and styles and in the size.

PHYLLODROMIA LORENZ-MEYERI, sp. n.* (Pl. 47. figs. 6, 17.)

♂ ♂. Nos. 5432, 5445, 5447, 5456, 5458, 5460, 5476, 5495, *5497*, 5501, 5502, 5505, 5508, 5537, 5538, 5549, 5561, 6714.

♀ ♀. Nos. *5504*, 5555, 6724, 6732, 6704, larvæ Nos. 5486, 6711.

♂. Dark castaneous. Vertex of head not covered by pronotum. Eyes wide apart. Antennæ not exceeding the apex of tegmina. Pronotum trapezoidal, posteriorly truncate, exposing the scutellum, lateral margins hyaline, but the hyaline not extending to postero-lateral angles which are concolorous with disc. Tegmina exceeding the apex of the abdomen, lateral margins narrowly hyaline; mediastinal and radial veins simple, 10–12 costals, discoidal field strongly reticulated, anal vein well-marked. Sub-genital lamina sub-trapezoidal, symmetrical, posterior margin slightly notched in the middle, styles minute, situated in small notches. Cerci pointed, 13-jointed, not exceeding apex of tegmina. Titillator strongly hooked, apex rounded. Front femora on anterior margin beneath with 4 spines, succeeded distally by piliform spines, 3–4 spines on posterior margin; remaining femora with 4–5 spines on anterior margin beneath, 3–4 spines on posterior margin. Metatarsus much longer than remaining joints.

♀. Shorter and broader, tegmina barely exceeding apex of abdomen; hyaline margins of pronotum broader; sub-genital lamina ample, produced, apex notched. Cerci stouter.

Length (♂) 10·5–14·5 mm.; (♀) 12 mm.

None of the specimens are in a very good state of preservation and it is not easy to make out the details of structure in them, the difficulty being increased by the dark colour of the species. The incomplete hyaline lateral margins of the pronotum afford the most obvious character whereby to recognize the species. There is considerable variation in size, and it is a little difficult at first to believe that the smallest example is specifically identical with the largest; but even after the most careful examination I am unable to find any character on which to separate the small specimens from the large. It is possible that the wing-venation or the structure of the supra-anal lamina might present discriminating characters, but as they are not visible in any of the specimens before me I have no option but to regard the

* Named in honour of my friend Herr Ed. L. Lorenz-Meyer, who has done so much to enrich the collections of the Hope Department, Oxford University Museum.

whole series of examples as representatives of one species. No. 5432 is not in a good state of preservation and is referred, with considerable doubt, to this species.

PHYLLODROMIA GERMARI, sp. n. (Pl. **47**. figs. 7, 8, 18.)

♂ ♂. Nos. 5433, 5441, *5444*, 5483, 5494, 5498, 5509, 5515, 5545, 5547, 5551, 5558, 6713, 6721.

♀ ♀. Nos. 5482, 5500, 5520, *5544*.

Larvæ. Nos. 5446, 5463, 5482, 5525, 5528, 5533, 5534.

♂ ♀. Testaceous, with a symmetrical piceous or castaneous pattern on the disc of the pronotum. Head piceous, vertex pale, a transverse pale band at base of the clypeus, mouth-parts pale. Antennæ longer than body and tegmina. Eyes wide apart. Pronotum trapezoidal, anteriorly not covering the vertex of the head, sides not deflexed, lateral margins hyaline. Scutellum exposed. Tegmina and wings exceeding the apex of the abdomen, of equal length in both sexes. Veins of tegmina paler than the ground-colour, which in well-preserved examples appears to be pale castaneous ; mediastinal and radial veins simple, marginal area broad, 11 costals, anterior ulnar 6-ramose, posterior ulnar simple, 5–6 axillaries. Sub-genital lamina (♂) produced, slightly asymmetrical, the apex forming an obtuse lobe, a stout style situated in a notch on the left of this lobe, a small slender style on the right ; (♀) large, strongly produced, apex emarginate. Cerci slender, pointed, not exceeding the apex of the tegmina, of 13 joints, the two apical joints minute. Front femora armed on anterior margin beneath with 4–5 spines, succeeded distally by piliform spines, on posterior margin 2–3 spines ; mid-femora with 3–4 spines on anterior margin beneath, 5 spines on posterior margin ; hind-femora with 2–3 spines on anterior margin, 4 on posterior margin. Formula of apical spines $\frac{2}{1}, \frac{1}{1}, \frac{1}{1}$.

Total length (♂) 12·5–14 mm. ; (♀) 11–12·5 mm.

Some larval forms that I refer without much doubt to this species have the mesonotum, metanotum, and abdominal tergites heavily blotched with castaneous ; the supra-anal lamina is trigonal. In one specimen (5534) the dorsal integument has been ruptured, and from the rent protrudes a portion of the alimentary canal.

PHYLLODROMIA YOLANDA, sp. n. (Pl. **47**. fig. 9.)

♂. No. *5523*.

Piceous. (Antennæ mutilated.) Vertex of head not covered by the pronotum. Pronotum trapezoidal, posteriorly truncate, exposing the scutellum, margined all round with testaceous, broadly on the lateral margins, narrowly on the anterior and posterior margins. Tegmina short, barely exceeding the

apex of the abdomen, their apices obtusely rounded, laterally margined with testaceous ; 14 costals ; discoidal sectors numerous, almost longitudinal, discoidal field reticulated, anal field elongate, more than one-third of total length of tegmina. Sub-genital lamina produced, asymmetrical, both styles, which are strongly chitinized, situated on the left side, the right style stout and bifurcate, the left style more slender, acuminate, and with a minute tooth near its base. Titillator nearly straight, acuminate. Cerci slender, exceeding the apex of tegmina, with 11 visible joints. Legs testaceous. Front femora armed with a complete row of spines on the anterior margin beneath, posterior margin sparsely armed.

Total length 12·5 mm.

Distinguished by the long anal field of the tegmina, the pronotum margined all round with testaceous, and the bifurcate style.

PHYLLODROMIA ANTIQUA, sp. n. (Pl. **47.** figs. 10, 16.)

♂. Nos. *5548* (adult), 5522 (larva).

Dark castaneous. Head piceous, antennæ longer than total length ; vertex not covered by the pronotum. Pronotum trapezoidal, posteriorly sub-truncate, lateral margins hyaline and extending inwards at the postero-lateral angles. Tegmina rather broad, not exceeding the apex of the abdomen by much ; marginal field broad, venation conforming to usual Phyllodromiine type, about 11 costals. Sub-genital lamina sub-trapezoidal, asymmetrical, the right style situated in the middle line and shorter than the left style. Cerci moderate, not exceeding the apex of the tegmina, with 11 visible joints. Front femora with a complete row of stout spines on anterior margin beneath, 3 spines on posterior margin ; mid- and hind-femora with 4–5 spines on anterior margin, 5 spines on posterior margin beneath, the latter longer than the former. Formula of apical spines $\frac{2}{1}, \frac{1}{1}, \frac{1}{1}$. No genicular spine on front femora.

Total length 15·9 mm.

In a small larva which I refer to this form the mesonotum is laterally bordered with testaceous, and the metanotum is entirely testaceous, except for a narrow piceous line along the anterior border.

PHYLLODROMIA LATISSIMA, sp. n. (Pl. **47.** fig. 11.)

♂. No. *5507*.

♀. Nos. *6703* (adult), 5540 (larval moult).

Broad, depressed, castaneous. Antennæ equal to total length. Vertex of head not covered by pronotum. Pronotum trapezoidal, lateral margins hyaline. Tegmina sub-ovate, not exceeding by much the apex of the abdomen ; marginal field broad, hyaline, 15–16 costals, discoidal sectors numerous,

oblique. Wings broad, semi-coriaceous. Sub-genital lamina (♂) sub-trapezoidal, a pair of long styles situated in deep notches; (♀) semi-orbicular, ample. Cerci rather short, stout, fusiform, apex blunt, 9-jointed. Legs piceous, coxæ edged with testaceous. Front femora with a complete row of strong spines on the anterior margin beneath, 2–3 spines on posterior margin; mid- and hind-femora with 4–5 spines on both margins beneath. Genicular spines well developed. Formula of apical spines $\frac{1}{1}, \frac{1}{1}, \frac{1}{1}$.

Total length 16·5–18 mm.

The species shows some affinities to the genus *Liosilpha*, Stål, and belongs to a section of the genus *Phyllodromia*, which will perhaps be raised eventually to distinct generic rank.

Phyllodromia tenacula, sp. n. (Pl. **47**. fig. 12.)

♂ ♂. Nos. *5519*, 6708.

Piceous. Vertex of head not covered by pronotum. Antennæ setaceous, longer than the body. Pronotum trapezoidal, lateral margins hyaline. Tegmina considerably exceeding the apex of the abdomen, mediastinal field hyaline; 16 costal veins, anal vein impressed; anal field moderately long. Sub-genital lamina produced, asymmetrical; right style short, stout, and beset with minute acuminate tubercles, left style slender. Cerci slender, with 12 visible joints, not exceeding apex of tegmina. Front femora with a complete row of strong spines on anterior margin beneath, 3 spines on posterior margin; mid- and hind-femora with 4 to 5 spines on both margins beneath. Formula of apical spines $\frac{2}{1}, \frac{1}{1}, \frac{1}{1}$; no genicular spines on anterior femora.

Total length 14·5 mm.; length of tegmina 11 mm.

Phyllodromia klebsi, sp. n. (Pl. **47**. fig. 15.)

♂. No. *a 2*.

Dark castaneous. Vertex of head almost covered by the pronotum, with 3 testaceous stripes. Pronotum trapezoidal, sides broadly hyaline. Tegmina and wings rather ample, extending considerably beyond the apex of the abdomen; tegmina with mediastinal area ample; about 14 costals, the last 2 or 3 ramose. Supra-anal lamina asymmetrical, posterior margin widely notched in the middle, 2 short teeth on the left side of this notch. Sub-genital lamina asymmetrical, with 2 slender styles, the left style straight and situated at the posterior angle of the plate, the right style sinuate and situated in a notch a little to the right of the middle line of the plate. Cerci moderate, blunt, with 9 visible joints. Front femora with a complete row of spines on anterior margin beneath, 3 on the posterior margin; mid- and hind-femora with 4–5 long spines on both margins beneath.

Total length 18 mm.

The apex of the abdomen in the unique specimen is somewhat obscured by clouding of the amber and by enclosed foreign particles, but I trust that I have succeeded in making out the details of structure successfully. Asymmetry of the supra-anal lamina in the Blattidæ is unusual, but by no means unknown (cf. *Anisopygia jucunda*, Sauss.); where it occurs it serves to mark a species very distinctly.

PHYLLODROMIA FURCIFERA, sp. n. (Pl. **47**. fig. 13.)

♂. No. *5539*. ♀. No. *6740*.

Piceous. Antennæ longer than total length. Pronotum trapezoidal, without pale margins. Tegmina rather narrow, not exceeding the apex of abdomen by much, outer margins not pale. Sub-genital lamina (♂) produced, asymmetrical; both styles, which are strongly chitinized, situated on the left side, the left style is slender and sharply pointed, the right style is larger, stouter, and bifurcate; (♀) semiorbicular, ample. Cerci slender, with 12 visible joints, exceeding apex of tegmina. Front femora with a complete row of spines on anterior margin beneath, 4 spines on posterior margin; mid- and hind-femora with 4–5 spines on both margins beneath. Formula of apical spines $\frac{2}{1}, \frac{1}{1}, \frac{1}{1}$; no genicular spine on front femora.

Total length (♂ & ♀) 16 mm.

The genital styles are remarkable, and I know of no recent species of the genus with styles at all like them; they recall, however, the genital styles of some W. African species of *Stylopyga* recently described by me.

PHYLLODROMIA BALTICA, sp. n. (Pl. **47**. fig. 14.)

♂. No. *5479*.

Dark castaneous. Antennæ longer than total length. Vertex of head not covered by pronotum. Pronotum trapezoidal, posteriorly very obtusely produced, lateral margins not hyaline. Tegmina not exceeding the apex of abdomen by much, about 12 costals; discoidal sectors oblique, numerous; anal vein well marked. Sub-genital lamina produced and very asymmetrical; two slender styles, the left slightly stouter than the right. Cerci rather stout, exceeding the apex of the tegmina, with only 9 visible joints, the apical joint rather large. Front femora with a complete row of spines on the anterior margin beneath, 3–4 spines on the posterior margin; mid- and hind-femora with 6 spines on anterior margin, 5 on posterior margin, beneath. Formula of apical spines $\frac{1}{1}, \frac{1}{1}, \frac{1}{1}$; genicular spines on all the femora.

Total length 13 mm.

Distinguished by the great asymmetry of the sub-genital lamina and by the stout cerci.

PHYLLODROMIA PRISTINA, sp. n. (Pl. 47. fig. 19.)

No. *5451*.

Piceous. Vertex of head not covered by pronotum. Pronotum trapezoidal, posteriorly truncate, exposing the scutellum, laterally broadly hyaline; at the postero-lateral angles the hyaline area is very broad and extends inwards irregularly towards the middle of the disc. Tegmina lanceolate, exceeding the apex of the abdomen, about 12 costals; discoidal sectors numerous, oblique; anal field rather elongate. Cerci moderately stout, exceeding the apex of the tegmina, with 12 visible joints.

Total length 11 mm.

The unique specimen is in a bad state of preservation and the sex cannot be determined, for the ventral scutes of the abdomen and the abdominal contents, as well as the legs, have disappeared. These injuries must have been caused prior to the inclusion of the insect in the amber, probably by some predatory insect, which, having devoured the more succulent portions of its prey, left the carcase to be overwhelmed later in a flow of resin. The pronotal pattern is the only character which I can employ to distinguish this species from its congeners. It is allied to *P. antiqua*, but is much smaller and darker.

As the species of *Phyllodromia* above described are only to be made out with some difficulty, I append the following key, which may render their determination easier. *P. pristina*, described from a single imperfect specimen, is omitted:—

1. Front femora armed on the anterior margin beneath with a few spines, succeeded distally by piliform spines.
    2. Dark castaneous; disc of pronotum unicolorous .... *P. lorenz-meyeri.*
    2′. Testaceous; disc of pronotum with a fuscous pattern.... *P. germari.*
1′. Front femora armed on the anterior margin beneath with a complete row of strong spines.
    2. Pronotum with the lateral margins distinctly hyaline.
        3. Pronotum anteriorly and posteriorly with pale margins. *P. yolanda.*
        3′. Pronotum without pale anterior and posterior margins.
            4. Hyaline lateral margins extending inwards at the postero-lateral angles........................ *P. antiqua.*
            4′. Hyaline lateral margins not extending inwards at the postero-lateral angles.
                5. Broad, depressed species .... *P. latissima.*
                5′. Narrower species.
                    6. Cerci slender, 12-jointed .... *P. tenacula.*
                    6′. Cerci short and obtuse, 9-jointed .... *P. klebsi.*
    2′. Pronotum with the lateral margins not hyaline.
        3. Right genital style bifurcate at apex .... *P. furcifera.*
        3′. Right genital style not bifurcate at apex .... *P. baltica.*

One species of the group, No. 5563, I leave undescribed, for it is represented by a single specimen which is so damaged that the important details of its structure are not visible.

CERATINOPTERA DIDYMA, *Germ. & Ber.*

Blatta didyma, Germar & Berendt, t. c. p. 34, pl. 4. f. 6.
? *Blatta elliptica,* Giebel, Z. f. d. g. Nat. xx. (1862) p. 315.

♀ ♀. Nos. 5434, 5472.

Two females that correspond well with the description and figure of this species. The tegmina appear to be semi-corneous, and their venation on account of the clouding of the amber cannot be made out at all distinctly. The femora are sparsely armed; the front femora have 3 spines in the middle of the anterior margin beneath, succeeded distally by piliform spines, there are about 4 spines on the posterior margin; the mid- and hind-femora have 2–3 spines on the anterior margin beneath, 3–4 on the posterior margin. Sub-genital lamina ample and semi-orbicular. Cerci moderate, fusiform.

Total length 11 mm.

CERATINOPTERA SOROR, sp. n.

♂. No. *7477*. ♀. No. *5901*.

Allied to *C. didyma*, Germ. & Ber., but larger and more stoutly built.

♂. Piceous, the pronotum bordered anteriorly and posteriorly with testaceous. Tegmina not exceeding the apex of the abdomen, venation more distinct than in *C. didyma,* mediastinal area broad, about 17 costals, anal vein impressed. Sub-genital lamina asymmetrical, similar to that of *Phyllodromia baltica* mihi, but with only one style, the left. Cerci stout, 9-jointed.

♀. Tegmina not extending beyond the 5th abdominal tergite, their apices sub-truncate. Apex of abdomen somewhat constricted; supra-anal lamina transverse, surpassed by the sub-genital lamina, which is semi-orbicular and ample. Front femora armed on the anterior margin beneath with a complete row of stout spines; mid- and hind-femora with 4–5 spines on the anterior margin, 5–6 on the posterior margin, beneath.

Length (♂) 10·5 mm., (♀) 11·1 mm.; length of tegmina (♂) 8 mm., (♀) 5·1 mm.

CERATINOPTERA CRUENTA, sp. n. (Pl. **48**. fig. 20.)

♀. No. *5529*.

Light castaneous. Antennæ longer than total length. Pronotum trapezoidal, sides deflexed, posteriorly sub-truncate. Scutellum exposed. Tegmina not reaching to the apex of the abdomen, lanceolate, apparently semi-corneous, venation indistinct; anal vein deeply impressed, not angulate. Abdomen broadly ovate; sub-genital lamina semi-orbicular, ample. Front femora with piliform spines only on anterior margin beneath, posterior margin unarmed; mid-femora with 3 spines on anterior margin beneath in the middle, none on posterior margin; the left hind femur with one spine on

anterior margin and none on posterior margin beneath, the right hind-femur entirely unarmed. Formula of apical spines $\frac{2}{0}, \frac{1}{1}, \frac{1}{1}$; no genicular spines on front femora.

Total length 8 mm.

I know of no modern representative of the genus with so sparse a femoral armature. The apex of the abdomen is obscured by some foreign body, so that it is not possible to examine the cerci or the supra-anal lamina.

Ceratinoptera klebsi, sp. n.

♀. No. *6731*.

Testaceous, with a piceous pattern on the pronotum and the veins of the tegmina piceous. Pronotum trapezoidal, posteriorly truncate. Tegmina lanceolate, not extending beyond the 5th abdominal segment; mediastinal area large, marginal area broad, 4–5 costals, 3 longitudinal discoidal sectors, anal vein well marked, 3 axillaries. Supra-anal lamina produced, angles rounded, surpassed by the sub-genital lamina, which is large and sub-cucullate. Cerci moderate, with 7 visible joints. Front femora on anterior margin beneath with 4 strong spines, succeeded distally by minute piliform spines; remaining femora strongly armed. Formula of apical spines $\frac{2}{1}, \frac{1}{1}, \frac{1}{1}$

Total length 8·1 mm.; length of tegmina 4 mm.; pronotum 2·3 mm. × 2·6 mm.

The unique specimen is in a bad state of preservation, but in size it is intermediate between the other species of the genus, and is readily distinguishable from them by its coloration and markings.

Temnopteryx klebsi, sp. n.

♂. No. *5461*. ♀♀. Nos. 5449, *6710*.

Castaneous. Antennæ longer than the body. Vertex of head not covered by pronotum. Pronotum trapezoidal, posteriorly truncate, exposing the large scutellum in the ♂, lateral margins paler than the disc. Tegmina quadrate, not extending beyond the middle of the first abdominal tergite, their sutural margins touching, outer and inner posterior angles rounded, marginal field broader and paler than disc, venation obsolete, anal vein not visible. Abdomen in the ♂ not tapering, the last 4 segments somewhat constricted, supra-anal lamina trigonal, apex sub-truncate, sub-genital lamina produced and slightly asymmetrical with two (?) blunt styles. Abdomen of the ♀ ovate, supra-anal lamina trigonal, sub-genital lamina produced, ample. Cerci rather blunt, with 9 visible joints. Front femora with a complete row of strong spines on anterior margin, 3 spines in the distal half of the posterior margin, beneath; mid- and hind-femora with 6 spines on anterior margin,

4 spines on posterior margin, beneath; all the spines strong. Formula of apical spines $\frac{2}{1}, \frac{1}{1}, \frac{1}{1}$.

Total length (♂) 12·5 mm., (♀) 13 mm.; greatest breadth of abdomen (♂) 4·5 mm., (♀) 5 mm.; length of tegmina 3·5 mm.; pronotum 3·2 mm. × 4·5 mm.

The three specimens are not in a very good state of preservation, and the ventral aspect of the abdomen in the male is obscured at the apex.

Subfam. Nyctiborinæ.

? Nyctibora succinica, sp. n.

♀. No. *5425* (larva).

This is a larval moult in a bad state of preservation, there being a large hole in the dorsal surface. Professor Klebs informs me that the specimen was found under fragments of wood enclosed in amber, and that he has never seen any other specimen like it in all the collections of amber-*inclusa* that he has examined. The specimen, though immature, is far larger than any other species of cockroach known from the amber fauna, and the adult form must have rivalled in size the modern representatives of the genus. I have already given reasons to account for the absence of large species in the amber fauna, and need not repeat them again.

It is rarely possible to place with absolute certainty any larval cockroach in its correct genus, and the systematic position of this species is open to considerable doubt. The unique specimen has a peculiar polished sheen on the thoracic tergites, and this appearance is due, I believe, to the presence of a minute sericeous pile (such as is highly characteristic of the Nyctiborinæ), in which air is enclosed. Except at the margins of the tergites it is not possible to detect the individual hairs of the sericeous pile even with a high-power lens; but when an insect is imbedded in a substance, such as amber, with the same refractive index as air, many minute details of sculpture and pilosity are lost, and the latter can only be inferred to be present by the optical effect produced when mechanically combined with air particles. At first I was inclined to place the species in the subfamily Blattinæ, but as the specimen is a female and in the structure of the sub-genital lamina exhibits none of the groovings which in larval Blattinæ foreshadow the valvular nature of the adult sub-genital lamina, it is certain that my first identification was incorrect. In its structure and facies the specimen agrees well with the characters of the Nyctiborinæ.

The following is a description of the unique specimen:—

♀. Piceous, with a silvery sheen on the thoracic tergites. Head damaged and distorted. Antennæ setaceous. Pronotum anteriorly parabolic, posteriorly truncate, wider than long. Meso- and metanotum with the posterior

angles strongly produced backwards. Surface of the thoracic tergites punctate, of the anterior abdominal tergites striate, of the posterior abdominal tergites reticulate; the spaces between these points, striæ, and articulations silvery. Angle of the posterior abdominal tergites strongly produced backwards. Supra-anal lamina triangular. Cerci robust, 11-jointed. Sub-genital lamina semi-orbicular, ample, posterior margin notched in the middle. Front femora with a complete row of short strong spines on the anterior margin beneath, other femora moderately armed, genicular spines long. Tibiæ stout, strongly armed, and with a sericeous pile. Tarsi with large pulvilli, metatarsi unarmed beneath, arolia large.

Length 21 mm.; pronotum 5·8 mm. × 10 mm.; mesonotum 3 mm. × 11·5 mm.

Subfam. Blattinæ.

Periplaneta succinica, sp. n.

♀. No. *5490*.

Rufo-castaneous. Antennæ fuscous at base, becoming rufous towards apex. Pronotum trapezoidal, not covering vertex of head, sides deflexed, posteriorly obtusely rounded. Tegmina semicorneous, extending to the antepenultimate abdominal tergite; 10 costals, the last 4 being ramose; discoidal sectors multiramose, some of the rami extending to the apex of the tegmen and also on to apex of marginal field; anal vein impressed, strongly bowed; surface of tegmina, especially in discoidal and anal fields, densely reticulated. Supra-anal lamina trigonal, sub-cucullate, apex emarginate. Sub-genital valves of the form typical of this subfamily. Cerci rather short, blunt, with 8 visible joints. Front femora with a complete row of strong spines on anterior margin beneath, only 1 on the posterior margin; mid- and hind-femora with 5 spines on both margins beneath, those on the posterior margin the longer. Genicular spines strong. Posterior metatarsus equal in length to the succeeding joints; pulvilli minute, apical.

Total length 18 mm.; length of tegmina 12 mm.

This is a beautifully preserved specimen, and there can be no doubt as to the correct systematic position of the species.

Subfam. Corydiinæ.

Polyphaga fossilis, sp. n. (Pl. **48**. fig. 21.)

♂. No. *5489* (larva).

Ovate. Rufous with recumbent pubescence. Vertex of head not covered by pronotum. Eyes wide apart, not markedly reduced in size. Antennæ short, moniliform in apical half; second and third joints sub-equal, twice as long as fourth joint. Pronotum anteriorly arcuate, posteriorly truncate, sides strongly deflexed. Posterior angles of meso- and metanotum slightly produced

backwards. Supra-anal lamina transverse with arcuate posterior margin. Cerci short, slenderly acuminate. Sub-genital lamina symmetrical, with two slender hirsute styles. Tibiæ short, equal to half the length of the femora; front tibiæ with 4 apical spines and 1 spine on the outer margin; mid-tibiæ with 5 apical spines, 2 on the inner margin near the apex and 4 on the outer margin; hind-tibiæ with 4 apical spines, 4 on the inner margin and 6 on the outer margin. Mid- and hind-femora with strong genicular spines.

Total length 4·1 mm.

This does not appear to correspond with any of the species figured by Germar and Berendt. The dorsal surface is marked by silvery streaks, due to the air entangled in the pubescence.

HOLOCOMPSA FOSSILIS, sp. n. (Pl. 48. fig. 22.)

♂. No. *5452*.

Castaneous. Eyes reniform, wide apart. Antennæ slender, about equal to the total length of the insect, not ciliated, apical joints moniliform. Vertex of head projecting considerably beyond the pronotum, which is trapezoidal, posteriorly truncate, and provided with an erect pubescence, sides deflexed. Scutellum exposed. Tegmina exceeding the apex of the abdomen; the mediastinal and anal fields, the basal two-thirds of the marginal field, and the extreme base of the discoidal field opaque, castaneous; the remainder of the tegmina hyaline. A sub-hyaline spot between the anal field and marginal field. The opaque part of the tegmina with a delicate recumbent pubescence. Veins very slender, about 7 or 8 costals, radial vein ramose at apex, about 9 discoidal oblique sectors, anal vein strongly angled. Wings with a prominent stigma on the anterior margin, formed by the incrassated rami of the mediastinal vein and by the fusion of some of the costal veins; rami of ulnar vein numerous, flexuose. Supra-anal lamina transverse, sub-bilobate; sub-genital lamina more produced, posteriorly emarginate, and with two slender styles. Cerci slender and rather elongate, with 9 joints. Legs and abdomen beneath rufous. Genicular spines on all the femora. Tibial spines stout.

Total length 7·1 mm.; length of tegmina 5·5 mm.

The single specimen is in an admirable state of preservation and is certainly the gem of the whole collection. By great good chance the right tegmen stands out at a considerable angle to the body, revealing perfectly the structure of the wing beneath. The species is undoubtedly most closely allied to the recent *H. minutissima*, de Geer, from Surinam.

Larval Forms.

A large part of the collection is made up of immature forms and moults. The latter were doubtless left adhering to the bark of the trees whence the resin exuded, and became enclosed in it. All but three of the species enumerated below belong to the subfamily Phyllodromiinæ, and I find it impossible to allocate any of them with certainty to any of the adult forms that I have described. Germar and Berendt figure four distinct forms, which they merely label A, B, C, D. The second of these is the only one that I can identify with certainty.

? Phyllodromia sp. (Larva B.)

Germar and Berendt, op. cit. pl. 4. fig. 3 B.

Nos. 5426, 5430, 5438, 5442, 5448, 5453, 5459, 5464, 5466, 5467, 5471, 5478, 5488, 5492, 5510, 5512, 5524, 5532, 5546, 5555, 6707, 6720, 6728, 6739, 6741.

I hoped to be able to identify this very abundant species with the equally abundant *P. lorenz-meyeri*, but the front femora are completely spined on the anterior margin beneath, and therefore the larvæ cannot belong to that species. The thoracic tergites are bordered laterally and in some examples posteriorly also with rufous. The third joint of the antennæ is very long, equal in length to about six of the succeeding joints. The body is provided with a sparse erect pubescence. The supra-anal lamina is triangular, and the sub-genital lamina of the older examples of the male sex is slightly asymmetrical and furnished with 2 styles. Superficially this larva bears a close resemblance to larvæ of the recent species *Loboptera nitida*, Germ.

? Phyllodromia sp.

Polyzosteria tricuspidata, Germar & Berendt, op. cit. p. 35, pl. 4. fig. 1 (1856).

Nos. 5431, 5443, 5517, 6718.

These larvæ certainly do not belong to the genus *Polyzosteria* as now defined.

The following are very young larvæ, which it is not possible to refer to any of the species described above:—

Nos. 5485, 5499, 5506, 5514, 5516, 5518, 5526, 5536, 5541, 5550, 5552, 5553, 5559, 6725, 6727, 6729, 6733, 6736, 6737, 6738, 6742, α 3.

All of the above belong to the section Blattæ armatæ, but the following are Blattæ muticæ:—

No. 5435. Apparently identical with *Polyzosteria parvula*, Berendt (Ann. Soc. Ent. France, vol. v. p. 542, pl. 16. fig. 1 (1836); Germar & Berendt, op. cit. p. 35, pl. iv. fig. 2 (1856)). The species, of course, is not a *Polyzosteria*.

No. 6716. A larval moult. The supra-anal lamina is triangular, the sub-

genital lamina is furnished with minute styles; the genicular spines are long, and arolia are present between the tarsal claws.

No. 6735 (Pl. **48**. fig. 23) is another very young larva which probably should be referred to the subfamily Perisphæriinæ. Since the species is more distinctive than any of the others enumerated above, it should be recognisable from the following description and figure, and eventually it may be possible to assign it to some adult form as yet undiscovered.

♂. Depressed, ovate, rufo-testaceous, without pubescence. Head completely concealed beneath the pronotum; eyes moderate, (?) approximated on vertex of head *; antennæ short, with 18 joints. Pronotum sub-cucullate, anteriorly parabolic, posteriorly truncate, a faint median sulcus extending on to the mesonotum. Posterior angles of the meso- and metanotum slightly produced backwards, those of the abdominal tergites more strongly produced. Supra-anal lamina subquadrate, posteriorly slightly emarginate, barely exceeding the sub-genital lamina, which is trapezoidal and furnished with two minute styles. Lateral margins of abdominal sternites overlapped by the tergites. Cerci very small, unjointed, and pointed. Legs short; femora unarmed beneath, their genicular spines minute; posterior tibiæ with the spines on the outer aspect triseriately arranged, with an interior calcar almost equalling in length the metatarsus. All the metatarsi much shorter than the succeeding joints, their pulvilli and arolia large.

Total length 5·5 mm.; greatest breadth 3·5 mm.

EXPLANATION OF THE PLATES.

Plate 47.

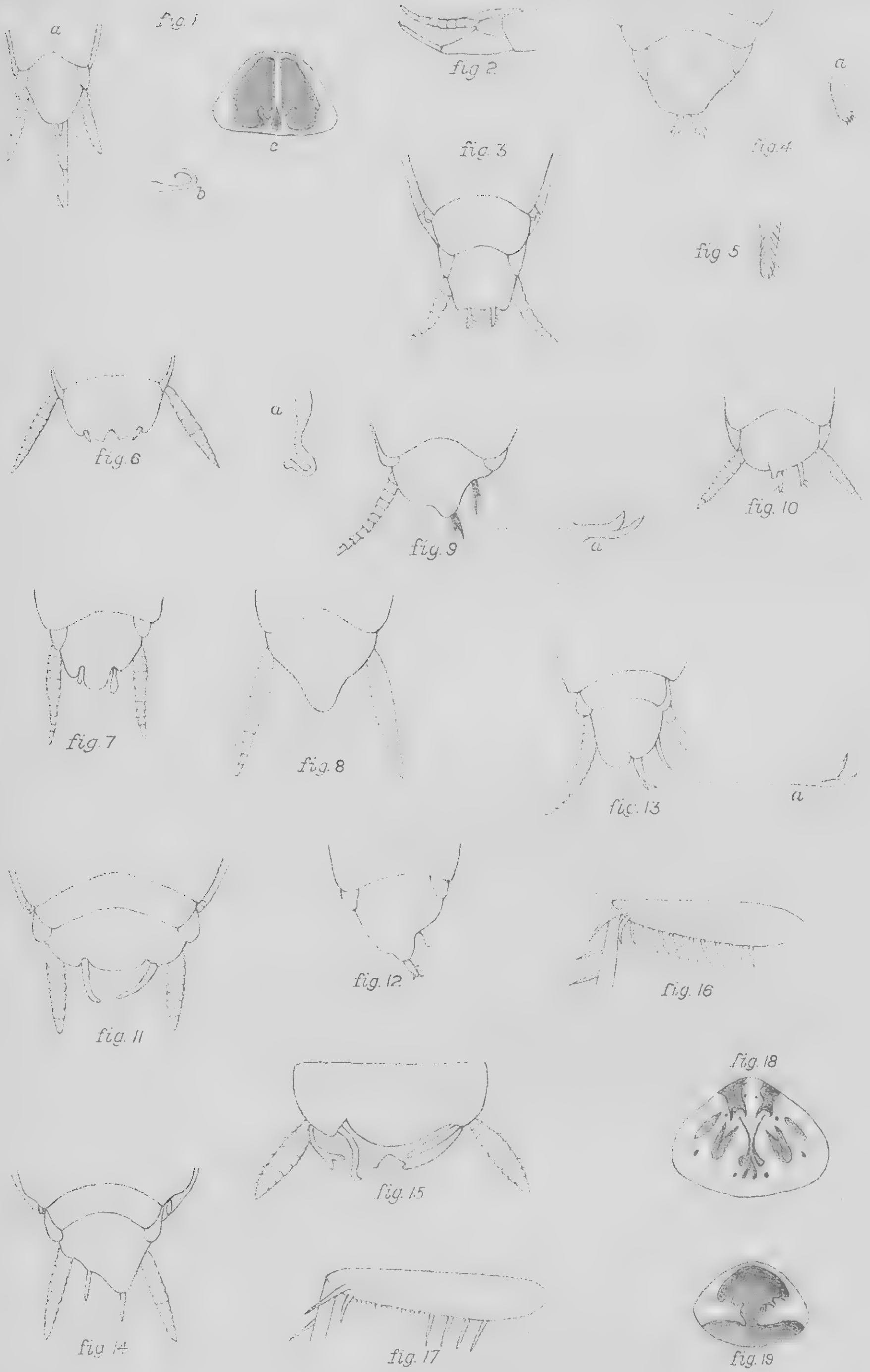
Fig. 1. *Ectobius balticus*, Germ. & Ber. *a*, apex of abdomen of male from beneath; *b*, titillator penis; *c*, pronotal pattern of specimen No. 5428.
2. *Ectobius inclusus*, sp. n., apex of abdomen of male from the side.
3. *Ischnoptera gedanensis*, Germ. & Ber., apex of abdomen of male from beneath.
4. *Ischnoptera klebsi*, sp. n., apex of abdomen of male from beneath. *a*, genital style.
5 Left genital style of *Ischnoptera perplexa*, sp. n.
Phyllodromia lorenz-meyeri, sp. n., apex of abdomen of male from beneath. *a*, titillator penis.
7. *Phyllodromia germari*, sp. n., apex of abdomen of male from beneath.
8. " " " " female from beneath.
9. *Phyllodromia yolanda*, sp. n., apex of abdomen of male from beneath.
10. *Phyllodromia antiqua*, sp. n., " " " "
11. *Phyllodromia latissima*, sp. n., " " " "
12. *Phyllodromia tenacula*, sp. n., " " " "

* This detail cannot be made out very clearly.

Fig. 13. *Phyllodromia furcifera*, sp. n., apex of abdomen of male from beneath. *a*, genital style.
14. *Phyllodromia baltica*, sp. n., apex of abdomen of male from beneath.
15. *Phyllodromia klebsi*, sp. n., " " " "
16. Front femur of *Phyllodromia antiqua*, ventral aspect.
17. " *Phyllodromia lorenz-meyeri*, ventral aspect.
18. Pronotal pattern of *Phyllodromia germari*.
19. " " *Phyllodromia pristina*, sp. n.

PLATE 48.

Fig. 20. *Ceratinoptera cruenta*, sp. n. ♀.
21. *Polyphaga fossilis*, sp. n. ♂ larva.
22. *Holocompsa fossilis*, sp. n. ♂.
23. Perisphæriine larva.



J.T Rennie Reid, Lith. Edin[r]

BLATTIDAE IN AMBER.

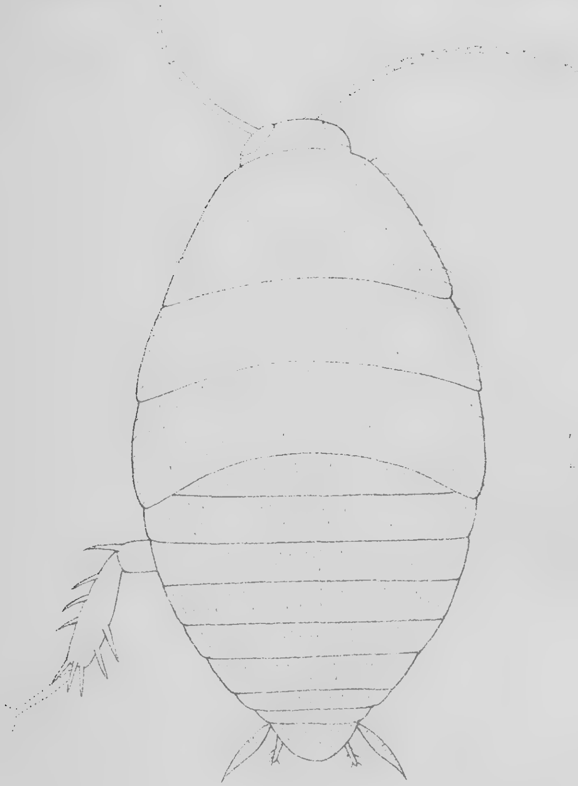


fig. 21

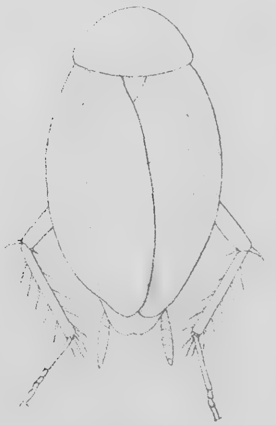


fig. 22

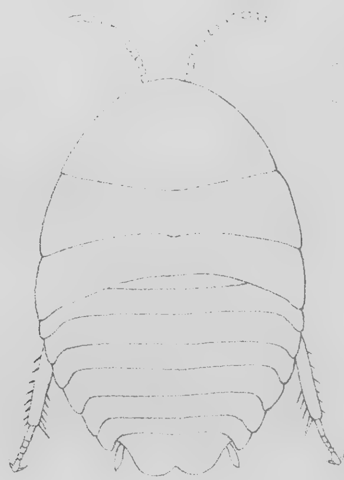


fig. 23

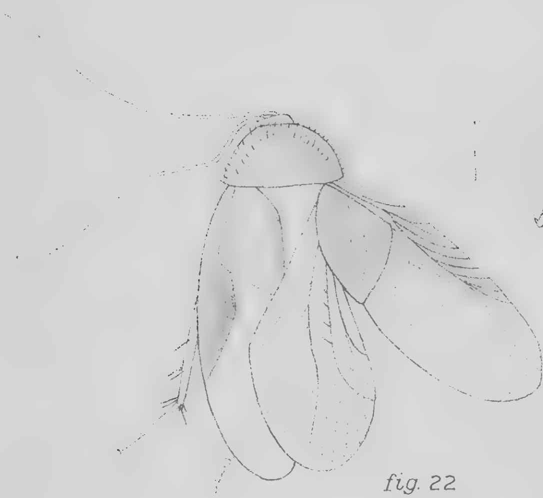


fig. 22

R. S. Del.

J. T. Rennie Reid, Lith. Edin.r

BLATTIDAE IN AMBER

NEW BLATTIDÆ

COLLECTED BY D^R SHEFFIELD NEAVE

IN THE KATANGA REGION OF CONGO

BY

R. SHELFORD, M. A., F. L. S.
(Oxford University Museum.)

EXTRAIT

DE LA

REVUE ZOOLOGIQUE AFRICAINE

Publiée sous la direction du D^r **H. SCHOUTEDEN** (Bruxelles).

VOL. I, FASC. 2. — 1911.

HAYEZ, Imprimeur des Académies
BRUXELLES

EXTRAIT de la *REVUE ZOOLOGIQUE AFRICAINE*, vol. I, fasc. 2, août 1911.

NEW BLATTIDÆ

COLLECTED BY Dr SHEFFIELD NEAVE

IN THE KATANGA REGION OF CONGO (1)

BY

R. SHELFORD, M. A., F. L. S.

(Oxford University Museum.)

FAM. BLATTIDÆ.

Sub-fam. *ECTOBIINÆ.*

Ectobius Neavei sp. n.

E. africano SAUSS. *simillimus, sed minor, tegmina* (♂) *haud fusco-punctata, tegmina* (♀) *valde abbreviata, quadrata.*

♂ Testaceous; frons castaneous. Pronotum with lateral margins broadly hyaline. Tegmina lanceolate, extending beyond apex of abdomen, some minute fuscous markings between the veins in the anal field and basal third of the discoidal field, radial vein emitting 4 rami towards the sutural margin. Wings hyaline, veins testaceous, the venation conforming to the type characteristic of the genus. Supra-anal lamina trigonal, surpassed by the sub-genital lamina which is asymmetrical, produced and furnished at the apex with one minute style. A large scent-gland opening on the antepenultimate abdominal tergite. Cerci and legs testaceous.

♀ Broader and shorter. Tegmina not extending beyond the 2nd abdominal tergite, sub-quadrate. Scutellum exposed. Wings absent. Abdomen densely fusco-punctate. Supra-anal lamina trigonal, sub-genital lamina semi-orbicular, ample.

Total length (♂) 11 mm., (♀) 7,8 mm.; length of body (♂) 8 mm.; length of tegmina (♂) 9 mm., (♀) 2 mm.; pronotum 2 mm. × 3 mm.

Loc. : Kasenga-Kalumba.

---

(1) From the collections of the Musée du Congo belge, Tervueren.

A large number of specimens of both sexes.

In *E. africanus* SAUSS. the ♀♀ have the tegmina and wings fully developed and in both sexes the tegmina are marked with distinct round fuscous points very different from the irregularly-shaped intervenular markings of this species.

Theganopteryx obscura sp. n.

Flavo-testacea; lamina supra-analis (♂) trigonalis, lamina subgenitalis producta, asymmetrica, stylis 2 minutissimis; cerci breves, basi contigui.

♂ Uniform flavo-testaceous. Head castaneous, antennae fuscous; eyes piceous, their distance apart on vertex of head nearly equal to the length of the 1st antennal joint. Pronotum posteriorly produced very obtusely. Tegmina with 23 costals, radial and ulnar veins simple, 7 discoidal sectors. Wings suffused with ochreous; 15 costals, medio-discal area in the middle about 4 times broader than the medio-ulnar area and crossed by 15 transverse venules, anterior ulnar bifurcate, the rami joining at their apices; a prominent triangular apical area. Scent-gland openings on the 2nd and 7th abdominal tergites; supra-anal lamina trigonal, surpassed by the sub-genital lamina which is produced, asymmetrical and furnished with 2 minute styles. Cerci short, sub-acuminate, situated close together at the base.

♀ Supra-anal lamina triangular, sub-genital lamina semi-orbicular, ample. Cerci longer and more slender.

Total length (♂) 11.1 mm., (♀) 11-5 mm.; length of body (♂) 10 mm., (♀) 8.5 mm.; length of tegmina (♂ and ♀) 9.1 mm.; pronotum 3 mm. × 3.5 mm.

Loc. : Kapema-Kipaila, 1 ♀.

The types of this species are in the British Museum and were obtained by Mr. S. A. Neave in S. E. Katanga and W. of Kambove.

Sub-fam. *PSEUDOMOPINÆ.*

Ischnoptera bisignata sp. n.

I. punctifronti GERST. *et I. Longstaffo* SHELF. *affinis; testacea, pronotum bivittatum; lamina supra-analis (♂) trigonalis brevis,*

lamina sub-genitalis valde producta, asymmetrica, stylis 2 attenuatis.

♂ Testaceous, a fuscous vitta between the eyes. Pronotum with 2 castaneous vittae. Tegmina and wings exceeding the apex of the abdomen. Tegmina with radial vein bifurcate from before the middle, 13-14 costals, the last 2 or 3 ramose, 8 longitudinal discoidal sectors, anterior ulnar bifurcate. Wings with mediastinal vein 4-ramose, radial vein bifurcate from beyond the middle, 10-11 costals, ulnar vein with 3 complete and 2 incomplete rami. Scent-gland opening as in *I. Longstaffi.* Supra-anal lamina shortly trigonal, much exceeded by the sub-genital lamina which is produced, asymmetrical and with 2 slender pointed styles situated close together at the apex. Front femora with a complete row of spines beneath, the more distal shorter.

♀ Similar, pronotum more heavily marked, abdomen beneath margined with castaneous, supra-anal lamina shortly triangular, apex non-emarginate.

Total length (♂ and ♀) 15-16 mm.; length of body (♂) 12 mm.; (♀) 13 mm.; length of tegmina (♂ and ♀) 12 mm.; pronotum 3.9 mm. × 4.1 mm.

Var. **microptera** n. var.

Entirely similar but with the tegmina and wings in both sexes not exceeding the apex of the abdomen.

Total length (♂ and ♀) 11 mm.; length of tegmina 8,1 mm.

Loc. : Kasenga-Kalumba, Kipaila-Kisinga, Madona, Bunkeya, Kilwa, Lukonzolwa.

A large number of both sexes in all stages of development. I know of no other species of this genus with micropterous males and females. In the larvae the fuscous pronotal vittae extend into the other two thoracic tergites and the abdomen is heavily mottled with fuscous.

In the key to the African species of *Ischnoptera* published in *Mém. Soc. ent. Belg.*, XV, p. 230 (1908) this species will follow *I. Longstaffi* and *I. punctifrons,* but is distinguished from both by the very short supra-anal lamina of the male.

Loboptera unicolor sp. n.

Picea, pronotum haud flavo-marginatum, tibiae spinis rufis, lamina supra-analis (♀) *triangularis.*

♀ Uniform piceous, nitid. Antennae fuscous. Tegmina narrow, squami-

form, barely extending beyond the mesonotum. Supra-anal lamina triangular. Cerci short. Apices of coxae, tibial spines and tarsi rufous. Front femora armed on anterior margin beneath with 4 strong spines succeeded distally by piliform spines; remaining femora strongly armed. Arolia minute.

Total length 11 mm.; pronotum 3.1 mm. × 4.2 mm.

Loc. : Bunkeya, Moneka, Madona. Kalalangombe. A long series of females only.

Sub-fam. *BLATTINÆ.*

Stylopyga congoensis sp. n.

Rufa; tegmina (♂ et ♀) *squamiformia, apice rotundato-truncato; styli genitales furcati, asymmetrici.*

♂ Unicolorous rufous, nitid; legs testaceous. Tegmina squamiform, broader at base than long. Supra-anal lamina trapezoidal, 7th abdominal tergite produced in the middle. Sub-genital lamina subquadrately produced; the right genital style forked, the inner limb of the fork being reduced to a small curved hook; the left genital style also forked, the limbs of the fork widely separated and some minute tubercles at the junction of the limbs. Cerci short, piceous, rufous at apex.

♀ Supra-anal lamina trigonal, apex faintly emarginate, truncate. Posterior margins of abdominal tergites slightly plicated.

Total length (♂) 16.17 mm.; (♀) 20 mm.; length of tegmina 3.5 mm.; pronotum 6 mm. × 7.5 mm.

Loc. : Kambove, Kalumba, Kiamokosa, Bunkeya, Kipaila, Lukafu : 3 ♂♂, 4 ♀♀ (adult) and a large number of larvae.

Allied to *S. manca* Gerst., but distinguished by the form of the genital styles, the asymmetry of which is an unusual feature of this genus.

Stylopyga Neavei sp. n.

S. anthracinae Gerst. *similis; picea, coxis, femoribus tibiisque rufo-castaneis; terga abdominis* 6^a *et* 7^a *marginibus lateralibus*

reflexis; lamina supra-analis (♂) trapezoidea; styli tenues, leviter curvati, haud furcati.

Differs from *S. anthracina* GERST. in the bright rufo-castaneous legs, in the deflexed abdominal tergites 6 and 7, with reflexed margins (the structure of these tergites resembling that in ♀♀ of *Pseudoderopeltis*), and in the form of the supra-anal lamina of the ♂. The posterior margin of the 1th abdominal tergite is produced and faintly emarginate. The female is very like that of *Pseudoderopeltis aethiopica* SAUSS. but the coxae are not blotched with paler colour and the supra-anal lamina is triangular and deeply emarginate at the apex.

Total length (♂) 18 mm., (♀) 19 mm.; length of tegmina 3 mm.; pronotum 6.1 mm. × 9 mm.

Loc. : Kaparowe, Bunkeya, Mfungwe, Madona-Bangweolo : 5 ♂♂, 8 ♀♀.

Blatta barbara sp. n.

Rufo-castanea, tegmina (♂) ovata, coriacea, segmento 4° abdominis haud attingentia, alae coriaceae; tegmina (♀) quadrata, segmento 2° abdominis haud attingentia, alae absunt; lamina supra-analis (♂) trapezoidea, styli graciles, haud curvati.

♂ Rufo-castaneous; head piceous; antennae piceous at base, remainder rufescent. Pronotum posteriorly truncate. Tegmina semi-corneous, obscurely reticulate-punctate, veins obsolescent, anal vein sometimes absent. Wings rather shorter than the tegmina. Cerci stout, acuminate. Sub-genital lamina sub-quadrate, apex not emarginate. Legs rufous.

♀ Similar but head rufo-castaneous. Scutellum exposed. Tegmina faintly punctate, veins entirely absent, outer margins faintly reflexed, inner margins overlapping. 7th abdominal tergite produced in the middle; supra-anal lamina triangular, apex faintly emarginate.

Total length (♂) 15 mm., (♀) 19.5 mm.; length of tegmina (♂) 7 mm., (♀) 5 mm.; pronotum 5.5 mm. × 7 mm.

Loc. : Kambove, Kaparowe, Madona-Bangweolo, Mpika-Fort Jameson : 3 ♂♂, 3 ♀♀ and larvae.

A male example taken between Mpika and Fort Jameson differs somewhat from the type, the tegmina approximating in shape and size to those of the female, but the specimen is in poor condition and I am not certain if it is not a mere variety.

Deropeltis sculpturata Krauss.

Deropeltis sculpturata Krauss, Zool. Jahrb., Abt. f. Syst., V, p. 651, pl. 45, ff. 2, 2a (1891).

Dr. Neave obtained some specimens which I regard as the females of this species, previously known from the male sex only.

♀ Opaque piceous; head rufous; legs testaceous. Dorsal surface closely and minutely punctate and with a sparse olivaceous tomentum. Pronotum anteriorly with 2 depressions, the disc with some smooth spaces. Posterior angles of thoracic tergites scarcely produced, those of abdominal tergites 5-7 very shortly produced. Posterior margin of pronotum faintly sinuate. Disc of abdomen at base castaneous.

Total length 19 mm.; pronotum 5 mm. × 8 mm.

Loc. : Kambove-Chitura, Dikulwe, Chaka-Kundiganu, Kayambo, 13 examples.

Bantua valida sp. n.

B. stigmosae Krauss *affinis, sed latior; pronotum antice tuberculatum, disco rugoso punctatoque, angulis posticis* (♀) *retroproductis, marginibus anticis reflexis; tegmina* (♂) *hyalina, vasi castaneo.*

♂ Head piceous, distance apart of eyes on vertex of head less than width of 1st antennal joint. Pronotum castaneous, anteriorly tuberculate with a short median carina, disc rugose and punctate, anterior margin slightly reflexed, posterior angles not produced, posterior margin minutely dentate. Tegmina and wings extending considerably beyond the apex of the abdomen. Tegmina with the veins and the basal third castaneous, the remainder hyaline. Disc of abdomen and legs testaceous, margins of abdomen castaneous.

♀ Piceous. Head punctate, distance apart of eyes on vertex of head greater than width but less than length of 1st antennal joint. Pronotum as in ♂ but larger and with the posterior angles backwardly produced; mesonotum and metanotum coarsely punctate, the posterior angles of the former slightly produced. Abdominal tergites finely rugose-punctate, sternites nitid and posteriorly margined with castaneous. Cerci small, ovate, testaceous. Legs rufo-castaneous. Supra-anal lamina rotundate.

Total length (♂) mm.; (♀) 20 mm.; length of body (♂) 19 mm.; length of tegmina 20 mm.; pronotum (♂) 5.5 mm. × 6 mm.; (♀) 7 mm. × 8 mm.

Loc. : Kambove-Kipaila : 1 ♂, 7 ♀♀.

[*From "The Transactions of the Second Entomological Congress*, 1912."]

A SYNOPSIS OF THE THYSANOPTEROUS FAMILY ÆOLOTHRIPIDÆ.

By Richard S. Bagnall, F.L.S., Hope Dept. of Zoology, University Museum, Oxford.

The *Æolothripidæ* are a small but abundantly characterised family of the *Terebrantia*, of which only about two dozen species are described. The fact that the species of this family are moderately large, and would therefore not be overlooked, goes to show that though widespread in their distribution the family is not largely represented, otherwise more material would have come into the hands of Thysanopterists.

The group is an interesting one, as it is apparently composed of the most primitive Thysanopterous insects, which, considering recent discoveries made in the United States of America, would seem to have originated in the New World.

Unlike most families of the order, the genera and species of *Æolothripidæ* can be separated on very satisfactory and definite structural characters.

Sub-order **Terebrantia.**

Family *Æolothripidæ.*

Antennæ nine-segmented, either freely movable or with the apical joints connate; intermediate segments usually cylindrical, without specialised chætotaxy, but uniformly clothed with short setæ. No sense-cones present; membranous, longitudinally elongated sensory areas on segments three and four, and smaller areas on certain other segments. Maxillary palpi geniculate, 3–8 segmented; labial palpi 2–5 segmented. Wings, when present, large, broad and rounded apically; forewing with a heavy ring-vein and two longitudinal veins reaching from base to tip and each uniting with the ring-vein before tip; cross veins usually present; front margin of forewings without, or

with only a light fringe of hairs. Legs long. Ovipositor curved backwards.

In the species of all other Thysanopterous families the joints of the maxillary palpi never number more than three, and of the labial palpi never more than two, and it is on account of the abnormal number of their palpal joints that the Æolothripid genera forming the Nearctic division *Orothripinæ* are of such interest. In describing the genus *Stomatothrips*, Mr. Hood makes some interesting generalisations on the probable evolution of the Thysanoptera, but of course, as Hood admits, we require a great deal more material—or evidence—before we can usefully or safely make such generalisations.

Key to the Genera of the Æolothripidæ.

1. All antennal joints freely movable[1]; joints of labial palpi fewer than in the maxillary palpi. 2
   Three or four terminal antennal joints closely united; maxillary palpi three-jointed, labial palpi four-jointed **Æolothripinæ** 6

2. Maxillary and labial palpi 8–5, 8–3 (or 4), or 7–5 jointed respectively. (Genera Nearctic.) . . . . . **Orothripinæ** 3
   Maxillary and labial palpi 3–2 jointed . . **Melanothripinæ** 5

3. Palpi 8–5 jointed; wings expanded apically *Stomatothrips* Hood.
   Palpi 8–3 (or 4) or 7–5 jointed; wings not expanded apically 4

4. Palpi 8–3 or 4 jointed; forewings with dark longitudinal bands along posterior margin; head longer than wide . . . . *Erythrothrips* Moulton.
   Palpi 7–5 jointed; forewings with dark cross bands *Orothrips* Moulton.

5. Second antennal joint produced apically in the form of a tooth . . . . *Ankothrips* Crawford.
   Second antennal joint simple . . . *Melanothrips* Haliday.

[1] I have not seen a specimen of *Stomatothrips*, which is described as having antennal "segments 7–9, more or less compactly united."

6. Head longer than broad, last three joints of antennæ connate . . . . *Rhipidothrips* Uzel.
Head transverse, last four joints of antennæ connate . . 7

7. Forewings with cross-veins . . . . *Æolothrips* Haliday.
Forewings without cross-veins . . . *Franklinothrips* Back.

OROTHRIPINÆ MIHI.

1. Genus **Stomatothrips** Hood, *Proc. Biol. Soc. Washington*, xxv., 1912.
Species: *S. flavus* Hood—Mexico.

2. Genus **Erythrothrips** Moulton, *U.S. Dept. Agriculture, Bureau of Ent., Tech. Ser.*, 21, 1911.
Species: *E. Arizonæ* Moulton—Arizona and California, U.S.A.

3. Genus **Orothrips** Moulton, *l.c., Tech. Ser.*, 12, 1907.
Species: *O. kelloggii* Moulton and var. *Yosemitii* Moulton—California, U.S.A.

MELANOTHRIPINÆ MIHI.

4. Genus **Ankothrips** Crawford.
Ankothrips Crawford, *Pomona Journ. Ent.*, ii., Mar. 1910.
Dicranothrips Trybom, in Schultze, *Zool. und Anthrop. Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika*, 1903–5. Jena 1910.
Prionothrips Schille, *Acad. Litt. Cracov.*, xlv., 1910.
Species: *A. robustus* Crawford (type)—California, U.S.A. *A. fissidens* (Trybom)—S. Africa. *A. niezabitowskii* (Schille)—Central Europe.

5. Genus **Melanothrips** Haliday, *Ent. Magazine*, iii., 1836.
Species: *M. fuscus* (Sulzer) (type)—Europe, N. Africa. *M. ficalbii* Buffa—Italy, England (1913).

ÆOLOTHRIPINÆ MIHI.

6. Genus **Rhipidothrips** Uzel, *Mon. der Ordnung Thysanoptera*, 1895.
Species: *R. gratiosa* Uzel (type)—Europe (Bohemia, England). *R. niveipennis* Reut.—Finland.

7. Genus **Æolothrips** Haliday, *Ent. Magazine*, iii., 1836.

Species: *Æ. fasciatus* (L.) (type)—Europe, North America, Africa. *Æ. bicolor* Hinds.—Massachusetts, U.S.A. *Æ. albocinctus* Hal.—Europe. *Æ. melaleucus* Hal.—Europe. *Æ. versicolor* Uzel.—Europe. *Æ. vittatus* Hal.—Europe. *Æ. tibialis* Reut.—Finland. *Æ. kuwanaii* Moulton—California, U.S.A. *Æ. vittipennis* Hood—Washington, D.C., U.S.A. *Æ. crassus* Hood—Illinois, U.S.A. *Æ. tiliæ* Bagn. (1913)—Norway.[1]

8. Genus **Franklinothrips** Back.

Æolothrips (in part) Crawford & P. R. Jones.

Franklinothrips Back, *Ent. News*, xxiii., 1912 (Feb.)

Mitothrips Trybom, *Ent. Tidskr.*, 33, 1912.

Species: *F. vespiformis* (Crawford) (type)—Nicaragua. *F. nasturtii* (P. R. Jones)—California, U.S.A. *F. megalops* (Trybom)—British East Africa. *F. longiceps* (Crawford)—California, U.g.A.

[1] Described in a paper appearing in forthcoming number of the *Journal of Economic Biology*.

NOTES ON AEOLOTHRIPIDAE, WITH DESCRIPTION OF A NEW SPECIES.

By

RICHARD S. BAGNALL, F.L.S., F.E.S.,

Hope Dept. of Zoology, University Museum, Oxford.

a. The Sub-families of the Family Aeolothripidae.
b. *Melanothrips ficalbii*, Buffa, an addition to the British Fauna.
c. *Aeolothrips tiliae*, n. sp., from Norway.
d. The genera *Franklinothrips* and *Mitothrips*.

(*a*) The Sub-families of the Family Aeolothripidae.

1. All antennal segments usually movable[1]; labial palpi with fewer segments than the maxillary palpi 2

Three, four, or five terminal antennal segments connate; maxillary palpi with three and labial with four segments.
Sub-family *Aeolothripinae*, mihi.

2. Palpi with an abnormal number of segments; namely, maxillary and labial respectively 8/5, 7/5 or 8/3 (or 4). Known genera Nearctic.
Sub-family *Orothripinae*, mihi.

Maxillary palpi with three segments and labial with two.
Sub-family *Melanothripinae*, mihi.

(*b*) Melanothrips ficalbii, Buffa, an addition to the British Fauna.

Melanothrips ficalbii, Buffa.

Buffa, Soc. Tosc. Sci. Nat. (Proc. verb.), July, 1907; and *l.c.* Memorie, 1907, xxiii, plates I and II.

Described from a few examples, including both sexes, found at Pisa, this species has not hitherto been recorded from elsewhere. It is sharply separated from the common *M. fuscus* (Suly.) by having the forewings banded (white with a dark band across middle, and another across tip), and the antennal joints two to four, yellowish, the fourth being tipped with grey-brown.

---

[1] In describing the genus *Stomatothrips*, Hood says of the antennae "segments 7-9 more or less compactly united."

[Journ. Econ. Biol., September, 1913, vol. viii, No. 3.]

On June 14th, whilst searching for *Rhipidothrips gratiosus*, Uzel, I secured several Aeolothripids from grass, etc., in a field on the Cherwell, near Oxford, which, with two exceptions, were referable to *Aeolothrips fasciatus* and *Melanothrips fuscus*. The exceptions were single female examples of *Rhipidothrips gratiosus*, Uzel., and *Melanothrips ficalbii*, Buffa. On the evening of the 17th June, Mr. J. Collins, of the Hope Department, secured a second example of *M. ficalbii* by sweeping long grass near Yarnton, where I have since secured another specimen.

I am especially pleased to be able to record this rare species as British.

(*c*) Aeolothrips tiliae, sp. nov., from Norway.

Aeolothrips tiliae, n. sp.

Female.—Length, 1.6 to 1.9 mm.

Colour blackish-brown (a crimson cast in certain lights, due to the deep hypodermal pigmentation), with joints three and four of the antennae, all tibiae apically, and all tarsi yellowish-white. Fore-wings white, with a brown band commencing at the basal fourth and extending to the apical fifth on the anterior margin, and almost to apex at posterior margin. Hind-wings with an obscure grey patch, extending from about one-half its length to the apical fifth.

Head slightly broader than long, sub-quadrate, cheeks behind eyes gently arcuate. Eyes rather coarsely facetted, occupying dorsally less than one-half the length of the head, but ventrally extending considerably towards base of the mouth-cone. Vertex raised in form of rounded hump; several minute setae on cheeks, dorsal part and vertex. Basal joints of antennae set below the vertex; approximate; third joint cylindrical; fourth about 0.8 the length of the third, slightly broadened distally.

Prothorax slightly transverse, about 0.7 as long as broad, and 0.9 the length of the head. Mesothorax narrower than prothorax and roundly widened to its juncture with the metathorax; metathorax narrowed to abdomen. Wings reaching to about the seventh abdominal segment; veins of fore-wing weak; cross-veins vestigial, so faint that they can only be discerned after close scrutiny under a high power. Setae along costa and longitudinal veins small, about 25 on costa, 17 on hind-vein, and 16-18 on fore-vein, the most distal eight being widely separated.

Cilia on lower margins only, moderately long and smoky-brown. Legs as in *tibialis*, set more or less regularly with short dark setae.

Abdomen elongate-ovate to eighth segment, ninth segment

nearly twice as long as the eighth, and narrowed evenly from base to apex of tenth (last) segment. Long bristles on ninth and tenth segments only; longer than the length of the tenth segment.

Type.—In Coll. Bagnall, University Museum, Oxford.

Habitat.—Not uncommon on lime (*Tilia*), Bygdø, near Christiania, June 27th, 1909 (R.S.B.).

I can only describe the female at present, from mounted specimens I made shortly after capture; but amongst my collections is a tube containing examples of both sexes, together with the earlier stages, which I have not at hand at present, but which I shall hope to describe later.

Separated (presumably) from all described species of *Aeolothrips s. str.*, by the vestigial nature of the cross-veins in the fore-wings. I was first inclined to refer the species to the recently diagnosed genus *Franklinothrips,* separated from *Aeolothrips* on account of the absence of these veins, but a close microscopical examination shows that the cross-veins in *tiliae* are present (or at least indicated!). I think it might be desirable to re-examine the Nearctic forms for any such indications.

A. tiliae most closely approaches *A. tibialis,* O. M. Reuter, and *A. versicolor,* Uzel., and may be distinguished from both by its larger size (1.6 to 1.9 mm., instead of 1.1 mm.), and by its relatively longer fourth antennal joint, which is only one-fifth (0.2) shorter than the third, instead of one-third (0.33) or two-fifths (0.4) shorter in the other species. It is further separated from *versicolor* by the colour of the body, and from *tibialis* by the coloration of the hind wing, which in the latter is clear white.

(*d*) The Genera Franklinothrips and Mitothrips.

In the Ent. Tijdskrift for 1912 the late Dr. Trybom described a new species of Aeolothripid from British East Africa, forming the type of the genus *Mitothrips,* and regarded it as congeneric with the recently described Nearctic species of *Aeolothrips*—*vespiformis, longiceps* and *nasturti.*

Before Trybom's paper was published, however, Back[1] published a note diagnosing the genus *Franklinothrips* with *vespiformis,* Crawford, as type, chiefly characterised by the absence of the cross-veins in the fore-wing,[2] so that, Trybom's and the Nearctic species

[1] Ent. News, Feb., 1912, xxiii.

[2] In these present notes I have already suggested that the Nearctic species should be re-examined closely for traces of cross-veins.

being congeneric, the name *Mitothrips* sinks as a synonym of *Franklinothrips,* as I have already stated in a paper on the Aeolothripidiae presented before the International Entomological Congress held at Oxford last year.

But a study of Trybom's species, *M. megalops,* shows that it is a very different form to the Nearctic species, and apart from the absence of the cross-veins in the fore-wings, and the shape of the head which strongly converges anteriorly and has exceptionally large eyes, the structure of the antennae is such as to make it difficult to regard the species as congeneric with *Franklinothrips.* The antennae are extremely long and slender (from 6 to 6.5 times the length of the head!), the abnormal length lying solely in the strangely elongated third and fourth joints, and the *five* apical joints are distinctly connate. I therefore consider that *Mitothrips* cannot be regarded as synonymous with *Franklinothrips,* and must be regarded as a separate genus.

Reprinted from the "Records of the Indian Museum,"
Vol. VIII, Part III, No. 13, September, 1913, p. 201.

ZOOLOGICAL RESULTS OF THE ABOR EXPEDITION, 1911-12.

XIII. THYSANOPTERA.

By RICHARD S. BAGNALL, *F.L.S.*, *Hope Department of Zoology, University Museum, Oxford.*

No doubt specialized collecting in more propitious season and circumstances would have produced numerous species of Thysanoptera. Only one species was collected, however, namely :

Sub-order **TUBULIFERA.**

Fam. ECACANTHOTHRIPIDAE, Bagnall.

Genus **Ecacanthothrips,** Bagnall.

E. sanguineus, Bagnall.

Acanthothrips sanguineus, Bagnall, Ann. Mag. Nat. Hist., ser. 8, i, p. 361, 1908 (Apl.).

Ecacanthothrips sanguineus, Bagnall, Ann. Soc. Ent. Belgique, lii, p. 349, 1908 (Dec.).—Trans. Nat. Hist. Soc. Nd. and Durham, n. s. iii, p. 535, 1909.

Ormothrips sanguineus, Buffa, Redia, v, fasc. 2, p. 166, 1909 (March).

Originally described from a single dried specimen collected by Dr. A. R. Wallace in New Guinea, it has since been recorded by Buffa from Sumatra, and the islands Mantawi (Mentawei) and Engano, and Dr. Karl Jordan has sent me it in large numbers from the Island of Nias. More recently Mr. E. Green has met with it in Ceylon.

It is a bizarre form, chiefly characterized by the congregation of finger-like sense-cones on the enlarged third antennal joint.

1 ♂ and 1 ♀ taken under bark by Mr. Stanley Kemp below Dosing (1400 ft.), January 29, 1912 ($\frac{2118}{19}$). Its occurrence in Northern India is interesting.

A FURTHER CONTRIBUTION TOWARDS A KNOWLEDGE OF THE BRITISH THYSANOPTERA (*TEREBRANTIA*).

By

RICHARD S. BAGNALL, F.L.S., F.E.S.,

Hope Department of Zoology, University Museum, Oxford.

With 5 Figures.

Since my last paper in this Journal was published I have had but little opportunity of collecting, my chief captures being made at the various field meetings of the Northumberland and Durham Natural History Society, during my year of presidency, 1911, and on two outings on the occasion of the British Association Meeting at Portsmouth, last year, when I spent some hours collecting in the New Forest, and at Blackgang Chine, Isle of Wight, with Mr. C. B. Williams. A few interesting Oxford captures are included in the following records, whilst the discovery of the new species, *Physothrips latus,* was made by my friend, Mr. H. S. Wallace.

It will be well to briefly point out certain necessary alterations in my preliminary list of the British Species (Journ. Econ. Biol., 1911, vi, p. 11).

1. The Genus *Euthrips,* Targ.-Tozz., should be known as *Physothrips,* Karny.
2. *Euthrips primulae,* Hal., should read *Taeniothrips primulae,* forming the type of that genus.
3. The Genus *Anaphothrips,* Uz., should be known as *Euthrips,* Targ.-Tozz.

In the Tubulifera:

4. The Genus *Anthothrips,* Uzel, becomes *Haplothrips,* Serville.
5. The Genus *Acanthothrips,* Uzel, becomes *Hoplothrips,* Serville, and the species *A. nodicornis,* Reut., must be known as *Hoplothrips corticis,* Serville. *Acanthothrips doanei,* Moulton, is also a synonym of *H. corticis.*

6. *Liothrips hradecensis*, m., has been compared with Uzel's type by Prof. Karny, who shows that the species are not identical, and that mine falls into his genus *Hoodia*. It must now be known as *Hoodia bagnalli*, Karny.
7. The species *Cephalothrips monilicornis*, Reut., is recorded by me from the New Forest, and must be added.

Certain questions relating to synonymy should also be made clear.

8. *Frankliniella vulgatissima*, Uzel nec Hal., becomes a synonym of *F. intonsa*, Trybom, and
9. *Physothrips pallipennis*, Uzel., must now be known as *P. vulgatissimus*, Hal.
10. *Physothrips longipennis*, Bagnall, has been redescribed by Moulton from North America under the name of *parvus*, which name must be sunk as a synonym.
11. The discovery of the male of *Bagnallia agnessae*, Bagn., shows it to be identical with *B. halidayi*, Bagn., described from male specimens only. The name *B. halidayi* is therefore reduced to a synonym.

In the following notes *Rhipidothrips gratiosus*, Uzel, *Chirothrips hamatus*, Trybom, *Frankliniella tenuicornis*, Uzel, *Physothrips latus*, sp. nov., *Bagnallia dilatata*, Uzel, *B. klapaleki*, Uzel, and *Stenothrips graminis*, Uzel, are brought forward as British.

Rhipidothrips gratiosus, Uzel.

Uzel, Monographie der Ordnung Thysanoptera, 1895, p. 66, pl. v, figs. 42, 43.

This fine, and moderately large species is easily recognised on the field on account of its unusual coloration, the ivory white prothorax and wings, and its black head, longer than broad, making it a conspicuous capture.

I have taken female specimens on two occasions by beating cereals in fields near Oxford, July 14th and 15th, 1912.

Previously known from Bohemia (Uzel).

Reuter has described a second species, *Rhipidothrips niveipennis*, from *Abies* and *Convallaria*, Finland.

Aeolothrips vittatus, Hal.

On pine, sparingly, females only. Prestwick Carr; Riding Mill, and near Hexham, Northumberland. I have also taken examples from pine in Southern Norway.

Melanothrips fuscus (Sulz.).

In various flowers, rare; both sexes. Gibside, Co. Durham; Wylam, Northumberland, and Oxford.

Chirothrips hamatus, Trybom.

C. hamata, Trybom, Ent. Tidskrift, 1895, xvi, p 187.

C. dudae, Uzel, Monographie der Ordnung Thysanoptera, 1895, p. 83, pl. i, fig. 7, and pl. v, fig. 50.

One female on rushes growing by side of Harbottle Lough, Harbottle, June, 1911, and another on grass (with *Cephalothrips monilicornis*, Reut., also an addition to the British fauna) at Matley Bog, New Forest, August, 1911. I characterised the species of *Chirothrips* in tabular form in this Journal (1909, vol. iv, p. 34).

Oxythrips ajugae, Uzel, 1895.

One female by beating pine branches, together with *O. brevistylis*, Harbottle, Northumberland, June, 1911.

Oxythrips brevistylis (Trybom).

A few by beating the male flowers of pine, Harbottle, June, 1911.

Oxythrips parviceps (Uzel).

In heaths, Harbottle district, June, 1911; New Forest, near Matley Bog, and Blackgang Chine, Isle of Wight, August, 1911.

Frankliniella tenuicornis (Uzel).

Physopus tenuicornis, Uzel, Monographie der Ordnung Thysanoptera, 1895, p. 99.

A single female taken on a soft grass by the side of Selby's Lough, near Harbottle, Northumberland, June, 1911.

Readily separated from *intonsa* (Trybom) by having the fifth joint of the antenna (which is somewhat strikingly slender) dark.

Physothrips latus, n.sp.

Length 0.9 mm., breadth of mesothorax 0.26 mm.

Female: general colour pale grayish-yellow; pigmentation of ocelli orange-red and of eyes purplish-black to crimson. First and third antennal joint clear grayish-yellow, second, fourth (base lighter), fifth, sixth and style grayish-brown. Wings grayish, pterothorax shaded to grayish-brown at sides, last two abdominal segments shaded to gray-brown, darkest at sides.

Form broad. Head with cheeks arched; inter- and postocular bristles present; together with a somewhat slender pair immediately behind the ocelli. Mouthcone shaded to dark grayish-brown at tip; reaching across prosternum; maxillary palpi 3-jointed, first joint slightly longer than the third, middle joint shortest.

Prothorax with a pair of fairly long bristles at each posterior angle, postero-marginal, mid-lateral and antero-marginal pairs present but smaller. Wings long; fore-wing with eighteen bristles on fore-margin, nine along the hind-vein, a series of six near base and two on apical third of fore-vein. Legs unusually long. Abdomen ovate, short and broad, but slightly longer than the length of the prothorax and pterothorax together, and three-quarters as broad as long. Last segment short and broad. Apical spines dark, long and strong on last two segments, moderately long on segment seven and weaker and shorter on sixth, other dorsal bristles minute and inconspicuous, lateral bristles well-developed.

Type.—In coll. Bagnall, University Museum, Oxford.

One female taken by Mr. H. S. Wallace in a garden on *Scabiosa* at Ninebanks, nr. Whitfield, Northumberland, in the summer of 1911. The Rev. J. E. Hull, of Ninebanks, sent me a tube of thrips containing other examples of *latus*, but at the moment it is mislaid amongst my numerous boxes of material.

Comes in the *orchidi*, Moulton, and *longipennis*, Bagn., group, and is easily distinguished from other species by its broad form and distinctive type of colouration. The antennae in the type specimen are set in such a fashion as to make it impossible to approximate the relative lengths of the joints.

Amblythrips ericae, Bagnall, 1911.

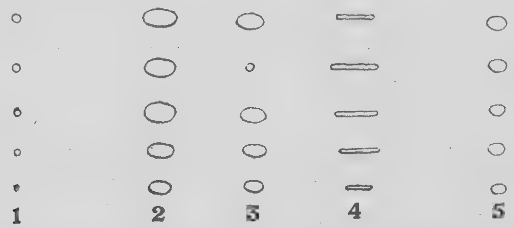
This larval-like little thrips is evidently not uncommon and widely spread in Great Britain, chiefly affecting the Cross-leaved Heath, *Erica tetralix*. In August, 1911, Mr. C. B. Williams and I took both sexes in fair numbers near Matley Bog in the New Forest, and in plenty in Blackgang Chine, Isle of Wight. In the spring of 1911 I met with a few examples in Gibside, Co. Durham, and in Tynedale at Riding Mill, whilst hard work produced a number on the moors near Harbottle, a village in the hills south of Cheviot, and ten miles from the nearest station, Rothbury.

Excepting in the structure of the genitalia, the male does not differ greatly from the female.

Bagnallia agnessae, Bagnall, 1911.

Syn: Male, **B. halidayi,** Bagnall, 1911.

This species occurs in large numbers in its original habitat, Gibside, and in April, 1911, I discovered it on the same species of grass growing near the margin of a pond in a Wear Valley dene near Fence-houses, Co. Durham.



Outline of areas on the underside of abdominal segments three to seven.

1. *Limothrips cerealium* (Hal.). Male.
2. *Bagnallia dilatata* (Uzel). Male.
3. *Bagnallia angusticeps* (Uzel). Male.
4. *Bagnallia agnessae,* Bagnall. Male.
5. *Stenothrips graminum,* Uzel. Male.

I have taken the male from both these localities in plenty; it is very unlike the female, and turns out to be the same form as the males described by me from Epping Forest under the name of *Bagnallia halidayi*. This latter name must sink as a synonym of *agnessae*.

All the females have short wings, whilst the males are brachypterous, the wings being reduced to white pads.

Bagnallia dilatata (Uzel).

Thrips dilatatus, Uzel, Monographie der Ordnung Thysanoptera, 1895.

A single mutilated specimen, male, taken in a flower of the March Red Rattle, *Pedicularia palustris,* Holystone, near Harbottle, Northumberland, June, 1911, is, I think, referable to this species.

Bagnallia klapaleki (Uzel).

Thrips klapaleki, Uzel, Monographie der Ordnung Thysanoptera, 1895.

A single dead and mutilated female beaten from rushes (with *Chirothrips hamatus,* Trybom) by the side of Harbottle Lough, agrees well with Uzel's description of *klapaleki*. The male is unknown. Previously recorded from Bohemia (Uzel) and Italy (Buffa).

Aptinothrips nitidulus, Hal.

On maritime plants: Ettrick Bay, on the Island of Bute, 1911, and at Lochgoilhead, May, 1912.

Stenothrips graminum, Uzel.

Uzel, Monographie der Ordnung Thysanoptera, 1895, p. 210, pl. ii, fig. 16.

Both sexes occur commonly on cereals in the neighbourhood of Oxford, July, 1912, and at Tring, August, 1912.

I had previously searched for *Stenothrips* in the North of England without success, and since finding it at Oxford I made a further search in the County of Durham, but only found *Limothrips cerealium* and *Haplothrips aculeatus*. *Stenothrips* is undoubtedly an injurious form apparently replacing *Limothrips* in some districts; it occurs in countless numbers.

It has been recorded from Bohemia (Uzel), Poland (Schille), Germany (Coesfeld), Italy (Ribaga), and Denmark (R.S.B.).

FURTHER NOTES ON NEW AND RARE BRITISH THYSANOPTERA *(TEREBRANTIA)* WITH DESCRIPTIONS OF NEW SPECIES.

By

RICHARD S. BAGNALL, F.L.S., F.E.S.,

Hope Department of Zoology, University Museum, Oxford.

It is particularly pleasing to note that Mr. C. B. Williams has taken up the study of the Thysanoptera and with gratifying results. Our work of the past year has not only considerably added to our knowledge of the British species, but has shown me that this group of the British fauna is very much richer than I had ever anticipated.

Our British list now stands at about 95 species, but this includes one or two critical forms, the descriptions of which I have held back until I have had the opportunity of comparing specimens with certain types in the Vienna Hofmuseum.

During the year Williams has discovered, and is bringing forward in a paper to be published shortly, *Rhipidothrips brunneus*, n. sp., *Euthrips badius*, n. sp., *Bagnallia asemus*, n. sp., *Bagnallia variabilis*, n. sp., and *Cryptothrips major*, Bagnall (originally described from a single Norwegian example), as new to the British fauna, and of these I have had the pleasure of taking *Euthrips badius* and *Cryptothrips major*. In two short papers I have myself brought forward *Melanothrips ficalbii*, Buffa[1] (previously only known from Italy), *Haplothrips distinguendus* (Uzel) and *Haplothrips juncorum*, Bagnall,[2] and in the present contribution *Scirtothrips ulmi*, n. sp., *Dendrothrips degeeri*, Uzel, *Thrips paludosus*, n. sp., *Thrips palustris*, Reuter, *Bagnallia biformis*, n. sp., and *Bolacothrips nigricornis*, n. sp., are recorded for the first time, the genera *Dendrothrips*, *Scirtothrips* and *Bolacothrips* not being previously represented in the British list.

I am pleased to acknowledge the help I have received from Commander J. J. Walker, Mr. A. H. Hamm, and Mr. J. E. Collins, who have not only placed their intimate knowledge of the Oxford district at my disposal, taking me to many of the best hunting grounds, but have helped me in other ways.

---

[1] Journ. Econ. Biol. Sept., 1913.

[2] Ent. Mon. Mag., Oct., 1913.

[Journ. Econ. Biol., December, 1913, vol. viii, No. 4].

Family **Aeolothripidae**.

Rhipidothrips gratiosus, Uz.

Another example (female) from the banks of the Cherwell, Oxford, in June, where I took the first examples last year. In moderate numbers, including a few examples of the male, on oats, Boar's Hill, New Hincksey, Ferry Hincksey, Abingdon and Cothill (Berks.), July and August, 1913.

Family **Thripidae**.

Sericothrips staphylinus, Hal.

Females only.—In *Galium* on the railway banks near Yarnton (Oxon.), July, and in *Ulex* on the Tors near Ilfracombe (N. Devon), common.

Frankliniella intonsa (Trybom).

Both sexes occur freely in the Marsh Red Rattle (*Pedicularis palustris*) at Hogley Bog, Cowley, near Oxford, July and August. By general sweeping on the Railway banks near Yarnton, June, 1913. (J. E. Collins and R. S. B.). One female from Wicken Fen (Cambs.), June, 1913 (C. J. C. Pool).

Frankliniella tennicornis, Uzel.

Single females from Wicken Fen (Cambs.), taken by Mr. C. J. C. Pool; near Yarnton (Oxon.), June, and Balsall Common, Warwickshire, September, 1913. First recorded as British last year from a solitary Northumbrian example.

var. **adustus**, Uzel.

Several examples of both sexes from barley, Marston Green, Warwickshire (H. Willoughby Ellis and R. S. B.).

Scirtothrips ulmi, n. sp.

Female.—This species very remarkably approaches *Physothrips ulmifoliorum* (Hal.) in size, shape and type of coloration, but the single bristle at each hind angle of prothorax and the generally shorter bristles, more especially the minute setae of fore-wings, show that it is referable to the genus *Scirtothrips*—perhaps a sub-genus of *Euthrips* (*Anaphothrips*)—and of the section wherein the sixth antennal joint is not divided.

It differs in other important particulars from *P. ulmifoliorum*.

The inter-ocular bristles are absent, and the postero-lateral prothoracic pair are minute. The two bristles on the distal half of the upper vein of fore-wing are widely separated. The eighth tergite is not fringed with minute setae along posterior margin, whilst the ninth tergite has not the pair of prominent dorsal bristles seen in *ulmifoliorum*. These comparative remarks apply almost equally well to *P. latus,* Bagn., which is most nearly related to *ulmifoliorum*.

The relative lengths of the antennal joints are approximately as follows:—

S. ulmi	...	7 : 11 : 13 : 12 : 11 : 15 : 3 : 4.5
P. ulmifoliorum	...	8 : 12 : 16 : 15 : 11 : 16 : 3 : 5

and the fifth joint in *S. ulmi* is not so broadly united to the sixth as in *P. ulmifoliorum*.

Male.—The ninth tergite (in *ulmifoliorum*, simple) is furnished with a pair of short, stout dorsal spines, one on each side of the midline, and a second shorter pair nearer to the posterior margin and slightly wider apart.

Habitat.—August and September, 1913, both sexes common. Under and on leaves of common elm, Oddington and Weston-on-the-Green, and in the neighbourhood of Oxford (Oxon.); and at Balsall Common and Marston Green, Warwickshire. On the wych elm, Abingdon (Berks.), and near Kirtlington and Henslow Bridge (Oxon.).

The following key, though containing species of two genera, may be useful.

Distal half of upper vein in fore-wing set with two bristles. Antennal joint 2 darker than 1 and 3.

1. Prothorax with two long bristles at each hind angle (*Physothrips*). Inter-ocular bristles present; setae on fore-wing long and stout and the 2 on distal half of upper vein close together. A pair of long dorsal bristles on 9th tergite and 8th tergite with posterior margin fringed with minute setae. Male (of *P. ulmifoliorum*) without specialized short stout spines on 9th tergite. 2

Prothorax with one long bristle at each hind angle (*Scirtothrips*). Inter-ocular bristles absent; setae of fore-wing short and weak, the 2 on distal half of upper vein widely separated. 9th tergite without long pair of dorsal bristles, and posterior margin of 8th tergite without fringe. Male with two pairs of short stout spines on 9th tergite.

Scirtothrips ulmi, n. sp.

2. Size smaller (0.75)[1]; form unusually broad; postocular bristles long. Colour light.

Physothrips latus, Bagnall.

Size larger (1.0 to 1.2 mm.), form normally broad; postocular bristles absent. Colour darker.

Physothrips ulmifoliorum (Hal.) Uzel.

Dendrothrips degeeri, Uzel.

Monographie der Ordnung Thysanoptera, 1895, p. 162, pl. vi, fig. 87.

This species is readily separated from *saltatrix*, Uz., by its darker coloration and much shorter head, whilst the antennae are only 0.2 longer than the breadth of the head. The other two species, *D. tiliae* and *D. saltatrix* might be expected to occur in the South of England.

Distribution.—One female and one male on Alder (*Alnus*) near Watersmeet, Lynmouth (N. Devon), August; numerous females and two males on Ash, Kirtlington Park (Oxon.), September, 1913. Previously known from Bohemia and Italy.

Oxythrips ajugae, Uzel.

In flowers of pine, University Park, Oxford, June, 1912.

Oxythrips parviceps, Uzel.

Common in heather and heath. Lynmouth, Ilfracombe and Lee Bay, North Devon, August; and Coleshill Bog, Warwickshire, September, 1913.

Euthrips (Anaphothrips) badius, Williams.

This interesting thrips was only discovered recently at Wicken Fen by Mr. Williams, who is describing the species under the above name.

I have taken a single female in a sedge stack at Weston-on-the-Green (Oxon.), August, 1913.

Aptinothrips rufus (Gmel.).

Male smaller than female, ninth tergite with one pair of specialized short and very stout dorsal spines, and a more slender pair nearer to the posterior margin, and placed about the same distance apart. My example is unfortunately mounted on its back, and it is difficult to appreciate the true position of these spines.

One example, banks of the Cherwell at Marston Ferry, near Oxford, August 22nd, 1913.

[1] Re-examination shows *latus* to be smaller than originally described.

Aptinothrips nitidulus, Haliday.

One female on the shore at Clovelly, N. Devon, August, 1913.

Thrips palustris, Reuter.

O. M. Reuter, Acta Soc. pro Fauna et Flora Fennica, xvii, 1899.

In his monograph of the Finnish Thysanoptera the late Prof. Reuter described several interesting species, amongst them *T. palustris* from the Lousewort, *Pedicularis palustris,* which comes nearest to *T. salicaria*. Though I have not yet recorded it, I took this species from the same plant in Southern Norway in the summer of 1909, and I was particularly pleased to find it again when collecting recently at Hogley Bog with Mr. A. H. Hamm. Most of the British examples are lighter than described by Reuter.

Distribution.—Females only, Hogley Bog, near Cowley (Oxon.), in the flowers of the Lousewort (*Pedicularis palustris*), August and September, 1913. Previously known from Finland (Reuter) and Norway (R. S. B.).

Thrips paludosus, n. sp.

Female.—Length, 1.0 to 1.1 mm.

General colour of head and thorax orange-yellow, very lightly tinged with grey; cheeks and frons sometimes greyish-brown. Abdomen greyish-yellow, last two segments dark grey, and segments six to eight sometimes more strongly tinged with grey. Legs yellow, very lightly tinged with grey. Antennal joint: 1, greyish-white; 2, greyish-yellow; 3, lighter yellow to grey-brown, lighter basally; and 5—7, grey-brown. Wings light greyish-yellow, cilia darker. All setae moderately dark.

Head transverse, 0.65 as long as broad and as long as the prothorax; basal third dorsally and laterally striate. Eyes coarsely facetted, pilose. Inter-ocular setae present, small. Maxillary palpi three-jointed, third joint the longest; second joint of labial palpi very long. Antennae about 2.2 times as long as the head, relative length of joints approximately—16 : 22 : 30 : 27 : 25 : 34 : 10; third joint pedicellate, 1 and 2 broader than any of the following; 3 to 5 practically subequal in breadth, and 6 but slightly broader.

Prothorax transverse, 1.8 times as broad as long, with two long bristles at each hind-angle (which are about 0.6 the length of the prothorax), and a series of three short pairs of postero-marginal setae, of which the inmost are the longest. The dorsal surface is very slightly convex, and the hind margin is impressed so that there is a more than usually distinct pre-marginal line which is also set with

a series of short setae and one long one at each angle. The whole surface is irregularly set with short setae including a more or less distinct antero-marginal series. Pterothorax large. Legs moderately long, pilose; hind tibia with a series of short stout spines on the apical half within. Wings long, reaching to seventh abdominal segment; spines on fore-wing prominent, three on apical half of upper vein, the most distal two somewhat widely separated.

Abdomen elongate, narrowing gently to apex from sixth segment. Apical bristles long, about 1.5 times as long as the segments bearing them. Ninth tergite with a pair of dorsal bristles in addition to the postero-marginal series, but only about 0.5 as long and inwardly curved distally.

Male.—Smaller and more slender, head, thorax and abdomen light greyish-yellow. Ninth tergite with six rather long and slender dorsal bristles, four (two pairs) set more or less regularly (two on each side of the mid-line) on a line across the middle of tergite, and the third pair on a lower plane, and not so widely separated as the outer pair of the upper series.

Habitat.—Apparently a bog species. Several examples, including a male, from sedge, and a cruciferous plant in the "peat pits" at Weston-on-the-Green (Oxon.), August, and further examples (females only) from *Erica tetralix* growing at the margin of Coleshill bog, Warwickshire, September, 1913.

This species is separated from *adusta* by its light colour, the coloration of the legs and antennae, and by the longer fifth antennal joints, and from all the little "yellow" species by the grey tip of body. It is further distinguished from *alni* by its larger size and the relative lengths and breadths of the antennal joints: from *albopilosus* by its larger size, the dark setae and wholly dark fifth antennal joint; and from *nigripilosus* by the larger size, shorter prothorax, and in having three setae in distal half of upper vein of fore-wing. *T. paludosus,* unlike *nigripilosus,* does not appear to have any pale depressed areas on the abdominal sternites in the male.

Bagnallia agnessae, Bagnall.

The female ranges from 1.45 to 1.65 mm. and the male from 0.85 or 0.9 to about 1.1 mm. in length.

The male is always brachypterous, the wings being reduced to wing-pads. The female is winged, and there are two forms, a short-winged and a long-winged form, most probably seasonal.

Female.—Forma microptera. The species was originally described from the short-winged form taken at Gibside, in October,

1910. Probably autumnal. The long-winged form was taken plentifully at the same place in the following spring.

Since this was written I have taken two females of this form and one male (brachypterous) at Balsall Common, Warwickshire. September, 1913.

Female.—Forma *macroptera, s.s.* In numbers, Gibside, early June, and at Fencehouses, April to June, 1911. A few examples on the canal banks near Yarnton, Oxon., June, 1913.

In this form the wings reach to the seventh abdominal segment. The fore-wing is smoky brown, light at base, and with a light irregular patch occupying the third fourth. In some specimens this is very noticeable, and the examples with wings folded are distinctly white-banded, as in *Odontothrips phaleratus.* The arrangement of spines, abnormally few, are as in the *forma microptera.*

Bagnallia biformis, n. sp.

A very distinctive species.

Forma typica. Female.—Length, 1.25 to 1.35 mm.

Dark greyish-black, head and abdomen slightly, but not strikingly darker. All femora grey-brown, inclined to be lighter apically, fore and intermediate tibiae yellowish, shaded with grey-brown along margins and near base; hind tibiae also yellowish, at least basal two-thirds usually grey-brown. All tarsi yellow. Fore-wings uniform dark grey, cilia smoky. Antennae with first two joints grey-brown, lighter apically; third light yellow, scarcely tinged with grey; fourth greyish-yellow; fifth to seventh grey-brown to grey-black. In very dark examples the femora and tibiae are dark greyish-brown, especially marginally, and lighter basally and apically.

Head practically as long as broad, and very slightly longer than the prothorax. Eyes not so prominent as in *agnessae,* but slightly bulging; coarsely facetted. Cheeks and ocelli as in *agnessae*; mouth-cone reaching across prosternum. Antennae about 1.75 times the length of the head; relative lengths of joints 3 to 7: 13 : 13 : 12 : 16 : 6. Much the same as in *agnessae,* but with the joints 5 and 6 narrower and more slender, equal in breadth to 4.

Prothorax transverse, 1.5 times as broad as long; two long bristles at each hind angle. Pterothorax 1.2 times as broad as the prothorax, longer than broad. Legs as in *B. agnessae.* Wings reaching to about the seventh abdominal segment; fore-wing with 14 bristles in lower vein, and 1 + 2 (the latter not close together) in the distal half of upper vein. Median vein of hind wing extending almost to apex.

Abdomen elongate, not much wider than the pterothorax; sharply narrowed from base of segment eight to apex. Bristles on segments nine and ten long, longer than the length of the respective segments bearing them. Lateral abdominal bristles much as in *agnessae,* one at each posterior angle of segments two to seven slightly curved.

Male.—Length, 1.0 to 1.1 mm.

Head yellow, cheeks and frons tinged with brown; prothorax light yellowish-brown; pterothorax also yellowish-brown, but deeply tinged with grey-brown, especially in the middle and laterally. All legs yellow; outside margin of femora, and sometimes of the tibiae, lightly (almost imperceptibly) tinged with grey-brown. Wings as in female, but reaching nearly to the ninth abdominal segment. Antennal joints one to four light yellow, two and three very slightly, and one and four more strongly tinged with grey; five to seven grey-brown to grey-black, basal half of five sometimes lighter with yellowish tinge. Abdomen from dark grey-brown to almost black.

Each of the sternites three to seven with a short transverse depression, rounded laterally: from 3 to 3.5 times as broad as long in sternite 7, to 5 to 5.5 times in sternite three.

var. **adusta**, nov.

Female.—Legs lighter, tibiae almost entirely yellow. Pterothorax and abdomen light grey-brown, with exception of the apex (*i.e.*, abdominal segments nine and ten and sometimes part of eight), which is deep greyish- or brownish-black.

var. **melanurus**, nov.

Male.—All abdominal segments, except the last three, yellow lightly tinged with grey, the seventh segment sometimes darker than the preceding.

Distribution.—Both sexes plentiful (the varieties also) in sedge stacks, Weston-on-the-Green (Oxon.), August, 1913.

Genus **Bolacothrips**, Uzel, 1895.

1. Size smaller (female 0.9 mm.). Antennal joints 1-4 yellow, ends of 3 and 4 usually greyish, 5 yellow with apical third dark, 6 dark grey, base or basal half yellow and 7 dark grey. Body setae light. Female, *B. jordani*, Uz.

2. Size larger (male 1.15 mm.). Antennal joints 3-7 wholly dark. Body setae strikingly dark. Male, *B. nigricornis*, n. sp.

Bolacothrips nigricornis, n. sp.

Male.—Length about 1.15 mm.

Light yellow, very faintly tinged with grey; pterothorax and apex of abdomen slightly deeper in colour. Eyes, antennal joints three to seven and thoracic and abdominal spines black.

Ocelli and wings absent.

Head about 0.9 as long as broad across eyes; frons rounded; eyes moderately large and prominent, cheeks slightly arched. Post-ocular and inter-ocular bristles present. Mouth-cone reaching across prosternum; maxillary palpi three-jointed; labial palpi two-jointed and rather longer than usual. Antennae with basal joint short, lighter than head; two, yellow, tinged with grey, rest black; joints three and four roughly ovate, practically sub-equal in length and narrower than two; five, about 0.85 the length of four, distinctly narrower and distally truncate; six, about 1.13 as long as four, elongate ovate, slightly broader than five but narrower than four; style about 0.35 as long as penultimate joint.

Prothorax not quite as long as head; about 1.75 times as broad as long. Two stout and moderately long bristles at each hind-angle, and the antero-marginal, mid-lateral pairs and the pair at anterior angles present and well-developed, not so stout and about 0.5 the length of those at posterior angles. Pterothorax transverse, but little broader than the prothorax. Legs stout, tibiae as broad as femora; well-furnished (especially the tibiae) with somewhat long setae, which are not, however, so strikingly dark as those on the thorax and abdomen.

Abdomen broadest at about segments four and five; apical bristles long and stout. Tergites two to eight furnished with several (usually three pairs, *i.e.,* six) long dorsal bristles, in addition to the usual bristles at posterior angles, more or less regularly on a line across middle and extending to or beyond posterior margin of the respective segments bearing them.

Sternites three to seven with a very short, strongly transverse depression, from ten times as broad as long on sternite seven to about twenty-five times on three and four.

Distribution.—One male beaten from a sedge stack with *Bagnallia biformis,* n. sp., *Euthrips badius,* Williams, and *Anthothrips distinguendus,* Uzel, at Weston-on-the-Green (Oxon.), August, 1913.

Stenothrips graminum, Uz.

Very common on various grasses in May and June, and on cereals, especially oats, in July. Oxford, Cowley, Yarnton, Odding-

ton and Weston-on-the-Green (Oxfordshire), and Abingdon, Cothill, Boars Hill, Ferry Hincksey and New Hincksey (Berkshire). A few examples, Ilfracombe, on oats, and Lynmouth, on grass in the woods near Watersmeet, August, 1913. Now known from Oxfordshire, Berkshire, Hertfordshire, and North Devon.

Platythrips tunicatus (Hal.).

Females only.—From heather, Ravenscar (Yorks.), September, 1910. A few examples in furze (*Ulex*) on the Tors, Ilfracombe (N. Devon), and in sedge stacks, Weston-on-the-Green, August, 1913. The male is as yet unknown.

CERATOTHRIPS BRITTENI, N. SP., A TYPE OF THYSANOPTERA NEW TO THE BRITISH FAUNA.

By RICHARD S. BAGNALL, F.L.S.

(With 1 Text-figure).

In 1899 the late Prof. O. M. Reuter described *Ceratothrips trybomi* from Sweden[1] forming the type of a new genus characterised by the unusual antennal features, and upon the strength of which I recently separated it from the Thripidae s. s.[2] To some these may seem small characteristics upon which to place such value, but in the classification of an Order one must study the relative values of the chief characteristics. Thus characters of value in separating genera and families in one Order may be of little or no value in another. For instance, a character often used in other insect Orders, the relative distances between the coxae, in the Thysanoptera persists unchanged throughout the two suborders Terebrantia and Tubulifera, whilst the structure of the tarsi are also subject to but little variation.

Again, taking the antennae, we see that the same general 8-jointed type[3] persists throughout the Tubulifera. In the Terebrantia, after setting aside the Aeolothripidae and the Heterothripidae, each with distinctive antennal characters, we get the large group generally known as Thripidae, and we find that of the numerous genera and species known from all parts of the world the same general type of antennae is common, *i.e.*, composed of 6 larger or main joints and a single or double-jointed style, and having joints 3 and 4 at least furnished with

[1] Acta Soc. Pro Fauna et Flora Fennica, 1899, xvii (Addenda, p. 65).

[2] Ann. & Mag. Nat. Hist., 1912, pp. 220-222.

[3] The few species bearing 7-jointed antennae being undoubtedly derived from an 8-jointed form, a joint being lost by the fusion of the two apical joints.

[Journ. Econ. Biol., March, 1914, vol. ix, No. 1.]

single or double trichomes. It is true that some species possess a 6-jointed antennae (*e.g.*, *Aptinothrips rufa* and *Drepanothrips reuteri*), but in such cases the 6th joint is not styliform but pyriform, and caused, undoubtedly, by fusion with the style, as proved by the fact that *A. rufa* possesses a normal 8-jointed form as well as the 6-jointed form.

Therefore the very constancy of the general type of antenna gives a considerably higher taxonomical value to any deviation than would be otherwise the case, and such were the considerations that weighed with me when I proposed the family Ceratothripidae.

That (in the light of recent material) the classification of the Terebrantia requires considerable modification, cannot be gainsaid, and it seems to me that it should be divided into two main divisions, or tribes, the one Aeolothripides (for Aeolothripidae) and the other Thripides (for Heterothripidae, Thripidae (s.l.) and Ceratothripidae).

Tribe THRIPIDES.

Fam. **Ceratothripidae,** Bagn.

Genus **Ceratothrips,** Reut.

Easily recognised by the very distinctive type of antennae which have five main joints (six in the rest of the Thripide genera) and a single-jointed style. The third joint is pedicellate, very small and without trichome.

Ceratothrips britteni, n. sp.

Length 1.3 mm., breadth of pterothorax 0.27 mm.

Colour dark grey-brown, head and thorax somewhat deeper in colour than the rest of the body. Apex of 2nd antennal joint, and pedicel and base of third yellowish-white. Fore-tibiae lighter grey-brown, excepting basally and along upper and lower margins, and extreme tips of hind- and intermediate-tibiae inclined to be light. Tarsi light grey-brown. Fore-wings including ciliae light greyish- or smoky-brown, spines black.

Head about 0.9 as long as broad, cheeks slightly swollen behind eyes and somewhat arcuate; surface irregularly and transversely striate. Eyes coarsely facetted occupying a little less than 0.5 the length of head, markedly pilose pigmentation black. Ocelli large, equidistant, posterior pair on a line drawn through posterior fourth of eyes; anterior ocellus protected by a pair of fairly long bristles. A series of setae on a line just behind eyes. Mouth-cone not quite reaching to base of prosternum. Maxillary palpi apparently 2-jointed, the

second being long and slender. Antennae 6-jointed, including a single-jointed style. Relative lengths of joints 1-4 as follows:—10: 16: 10 (with pedicel): 19, and 5 and 6 together (distorted in the unique preparation) approximately 32; 3 much narrower than either 1, 2, 4, or 5, and 1 at least as broad as 2. 4 with a stout (and apparently double) trichome, and 5 with a transverse pale area; long dark bristles on inner side of 1 and encircling 2 to 4.

Prothorax about as long as head, transverse, 1.65 as broad as long, posterior margin depressed (as in *Thrips paludosus*, Bagn. and others); two long, stout bristles at each posterior angle which are about 0.7 the length of prothorax, and a series of 3 additional postero-marginal pairs, the inmost being the longest and about 0.4 the length of those at posterior angles. Surface somewhat sparingly furnished

Ceratothrips britteni, n. sp.
First four joints of left antenna, × c. 350.

with fine setae, mostly about 0.2 the length of the prothorax. Pterothorax broadest at juncture of meta- and mesothorax, where it is about as broad as long and 0.3 broader than the prothorax. Legs rather stout, hind pair longest; all femora and tibiae setose and hind tibiae in addition having the distal two-thirds within armed with a series of long, stout spines. Wings reaching to about the base of 9th abdominal segment. Fore-wing more than 12 times as long as broad through middle: costa with 22-23 setae; lower vein 11-12, the most distal being slightly remote; upper vein with a series of 3 near juncture with hind vein, and then a series in distal half, in one wing 7 (5 + 2) and in the other 8 (7 + 1).

Abdomen oblong-ovate, broader than pterothorax, broadening

gently to 4, 4-6 sub-equal, thence narrowing gently to 9, and then more sharply to apex. Apical bristles long and strong, those on 9 (excepting inmost pair) about as long as segments 9 and 10 together; those on 10 only slightly shorter. Posterior margin of 8th tergite minutely fringed, 9 with a pair of dorsal bristles about 0.4 the length of the postero-marginal ones, 10 divided above almost to base. Lateral abdominal bristles moderately long.

This species is easily separated from *C. trybomi*, Reut., by the coloration of the body and antennae, the chaetotaxy of the forewings and larger and broader basal antennal joint.

Type.—In Hope Collections, University Museum, Oxford.

Habitat.—One female taken by Mr. Britten (after whom I find pleasure in naming the species) in the flowers of Devil's Bit Scabious *Scabiosa succisa*), Great Salkeld, Cumberland (Sept. 16th, 1913), with numerous examples of *Physothrips vulgatissimus*, Hal. (*pallipennis*, Uz.), *Ph. atratus*, Hal., etc.

ON TWO NEW SPECIES OF THYSANOPTERA FROM THE WEST INDIES.

BY

C. B. WILLIAMS, B.A., F.E.S.,

The John Innes Horticultural Institution, Merton, Surrey.

WITH 2 FIGURES.

MR. FRANK BIRKINSHAW, of the Agricultural Experimental Station, Kingstown, St. Vincent, has recently been kind enough to send me two small collections of thrips which he had taken in the grounds of that station on Cacao and Bitter Cassava [*Mandiocca (Manihot) utilissima.*]. The collection from Cacao consisted entirely of larvae and adults of *Heliothrips rubrocincta* (Giard); that from the Cassava contained two species, both of which appear to be new, and are described below. One of these belongs to the genus *Frankliniella,* Karny, and approaches very near to *Fr. cephalica* (Crawford). For the other it has been found necessary to erect a new genus, which differs in several respects from the known genera of the Thripidae, s. str., but is best retained in this family in the present state of our knowledge of this group. Mr. Birkinshaw, in respect of the species of Cassava, writes: "The manihot leaves are injured somewhat, so, of course, do not develop properly; the pest, however, does not appear to be a source of very great injury, as far as the yield is concerned, unless it should be present in large numbers." When writing the above, Mr. Birkinshaw was unaware that two species were present, so I cannot say to which one in particular his remarks refer.

Fam. **Thripidae.**

Gen. **Corynothrips,** nov.

Head produced forward in front of the eyes. Antennae long and slender, apparently nine-segmented, owing to the presence of an oblique cross division in the sixth segment. Maxillary palps two-jointed; labial palps two-jointed, the basal joint very short and obscure. Two spines on each hind angle of the prothorax and one on each front angle. Legs long and slender. Wings very narrow

and curved forward at the tip. Fore vein of the front wing merged with the front margin; hind vein short and inconspicuous. Abdomen long and narrow. All the long spines on the wings and body minutely spinulose at tip.

Type, *Corynothrips stenopterus*, n. sp.

This genus may easily be distinguished from all known genera of Thripidae by the venation of the fore wing and by the spinulose tips to all the spines. It is further separated from all genera except *Ctenothrips*, Franklin, by the prolongation of the head in front of the eyes to form a "crown." From this genus and from all other genera except *Euthrips* (*Anaphothrips*) in part, it is separated by the oblique division of the sixth antennal joint.

Corynothrips stenopterus, n. sp.

(Fig. 1.)

Female. Measurements.—Head, length, 0.17 mm., width across eyes, 0.138 mm.; prothorax, length, 0.138 mm., width, 0.189 mm.; pterothorax, length, 0.247 mm., width, 0.247 mm.; abdomen, length about 0.84 mm., width, 0.218 mm.; wing, length (from tip of basal lobe), 0.653 mm., width, about half way along, 0.029 mm.

Antennae.—

Segment	1	2	3	4	5	6	7	8
Length (μ) -	17.5	45	85	75	62.5	47.5 + 15	12.5	17.5.
Width (μ) -	27.5	27.5	20	16	12.5	12.5	5	4

Total body length about 1.4 mm.; antennae, 0.375 mm.

Colour.—Yellow with brown and red markings. The whole of the dorsal surface and the anterior part of the ventral surface of the head, brown; the dorsal surface of the prothorax irregularly but nearly symmetrically marked with red brown. A dorsal red brown blotch on abdominal segments 3, 4, 6, 7 and 8, that on segment 6 being faint and small, the others larger. The last two abdominal segments brown. The mouth-cone, pterothorax, legs and rest of the abdomen yellow.

Head (Fig. I*a*) longer than broad, produced between the eyes into a blunt prominence on which the antennae are placed, cheeks slightly arched, back of the head slightly striated. Eyes large, black, and very protruding. Ocelli present, very close together, the two posterior red (probably due to the presence of red pigment beneath), the anterior in a line with the front of the eyes, colourless and facing forward. Crescents indistinct. A very long hair just anterior and dorsal to each posterior ocellus, a very short hair at each side of the anterior ocellus and a few other short ones behind each eye. Mouth-

cone long and rather blunt, reaching across the prosternum. Maxillary palps two-segmented, the second segment about six times as long as the first, with three sensory bristles at the tip, and three others lower down (Fig. I*c*). Labial palps two-segmented, the basal segment very short and indistinctly separated from the labium, the apical segment long and slightly curved with three sensory bristles at the tip (Fig. I*d*). Antenna (Fig. I*b*) apparently nine-segmented,

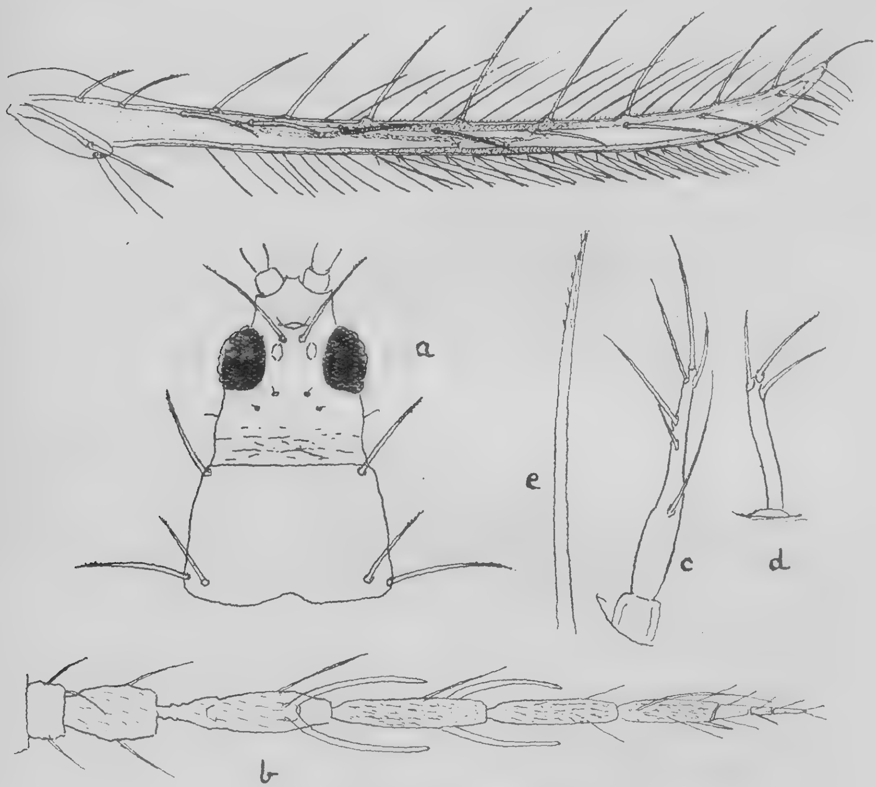


Fig. 1.—*Corynothrips stenopterus*, n.sp.

a, head and prothorax; *b*, antenna (from above); *c*, maxillary palp; *d*, labial palp; *e*, spinulose seta; *f*, wing (posterior fringe not completed).

owing to the presence of a slightly oblique division in the sixth segment; long and slender, over twice the length of the head. The first segment short and cylindrical; the second longer and barrel-shaped; the third long and thin, irregularly narrowed to a short pedicel at the base; the fourth and fifth long and narrow, slightly constricted at the base; the sixth slightly narrowing beyond the cross division; the eighth slightly longer than the seventh. All the seg-

ments are covered with minute hairs. The apical segments have longer hairs also, one at the base of the sixth segment being particularly noticeable. A very long forked trichome on the dorsal side of the third segment, and a similar one on the ventral side of the fourth. The first and second segments are brown; the third red brown to the base of the trichome; the fourth clear to the base of the trichome, then slightly darker; the fifth clear, slightly darker at the tip; the sixth, seventh and eighth clear.

Prothorax irregularly marked with red brown, shorter than the head, gradually widening behind. One long, slender bristle at each front angle, and two at each hind angle, one slightly more dorsal and shorter than the other. These long spines, and also the two on the head between the ocelli have a double row of minute spines on one side towards the end (Fig. I*e*). The hind margin of the pronotum is slightly indented in the dorsal middle line. Pterothorax large, front angles rounded, gradually narrowing behind. Legs very long and slender, all tibiae slightly widened distally. Fore tarsi unarmed, hind tibiae with only very weak spines. There is a dark spot at the base of the second tarsal joint in each leg. Wings very long and narrow, strongly curved forwards at the tip. Fore wings (Fig. I*f*) clear, except for the middle third, which is darker with both margins, and for a short distance a median line, red brown. The fore vein is, except at the very base, apparently merged with the costal vein, the two forming a broad anterior margin somewhat similar to that in *Panchaetothrips,* Bagnall. There are nine spines on the costal vein, two on the basal part of the fore vein, and eight on the part of the vein fused with the costa. The first two spines in the dark area on the fore vein are also dark. A little before the dark area in the middle of the wing the merged costal and fore vein gives off a very indistinct posterior branch which runs along the middle of the wing, becoming red brown and conspicuous as it crosses the dark area, and disappearing either at or a little beyond the third spine on the fore vein after the fork. This branch appears to fuse partially with the fore vein at the first and third spines after the fork, the first of these spines being between the fore vein and the branch. The costal vein is continued round the tip of the wing along the hind margin as far as the tip of the basal lobe. The basal lobe is indistinctly separated from the rest of the wing, and bears one spine on the dorsal side and two finer wing-retaining spines on the ventral side. All the spines on the wing are spinulose at the tip. The fringe on the posterior margin is very long. Hind wings clear, curved forwards at the tip. The single vein is distinct almost to the tip of the

wing and is dark, conspicuous, and minutely sinuate. There are two short spines in the middle of the wing near the base, and two longer ones on the lobe.

Abdomen rather long and narrow, with only very short hairs, except on the last two segments. On these there are several long hairs, which are also spinulose at the tip.

Described from about thirty females found on Cassava plants (*Mandiocca utilissima*) in the Agricultural Experimental Station, Kingstown, St. Vincent, West Indies, by Mr. F. Birkinshaw, in October, 1912.

Type in the Hope Department, Oxford University Museums.

Egg.—In one of the specimens an egg is visible in the abdomen. It is elongate kidney-shaped, about 0.25 mm. long by 0.06 mm. broad. It is situated longitudinally, and reaches from the middle of the third segment to the hind margin of the fifth.

Frankliniella melanommatus,[1] n. sp.

(Fig. 2).

Female. Measurements.—Head, length, 0.112 mm., width, 0.150 mm.; prothorax, length, 0.125 mm., width, 0.185 mm.; pterothorax, length, 0.22 mm., width, 0.25 mm.; abdomen, width, 0.25 mm., length, about 0.58 mm.; wing, length (from tip of basal lobe), 0.55 mm., width, about half way along, 0.045 mm.

Antennae.—

Segment	1	2	3	4	5	6	7	8
Length (μ)	20	35	55	50	37.5	45	7.5	10
Width (μ)	27.5	25	22.5	20	17.5	15	7.5	5

Total body length, 1.1 mm.; antennae, 0.27 mm.

Colour.—Yellow, apical segments of the antennae a little darker. Eyes, dark red-brown.

Head (Fig. 2*a*) broader than long, rectangular, slightly retracted into the prothorax; cheeks parallel; back of the head not striated. The only conspicuous spines are one behind each eye [2] and one just in front of each posterior ocellus. Eyes large, dark, not protruding. Ocelli present, the two posterior on a level with the back of the eyes, the anterior one slightly directed forwards into a depression on the front part of the head. Crescents distinct, dark yellow. Mouth-cone reaching almost across the prosternum. Maxillary palps three-segmented, the third segment the longest. Labial palps two-segmented, the basal segment very short. Antennae (Fig. 2*b*) more than twice

[1] μελανομματος = with dark eyes.

[2] This has been omitted by accident in Fig. 2*a*.

the length of the head, the first segment short, cylindrical; the second produced dorsally into a blunt tubercle bearing two stout dark spines (Fig. 2*c*); the third with a dorsal forked trichome and, below the base of this, two dark spines not quite as stout as those on the second segment; the fourth with a ventral forked trichome; the eighth longer and narrower than the seventh. Colour: the first segment clear, the second and third tinged with grey at the apex, the fourth tinged with grey in the apical third, the fifth clear, the sixth, seventh and eighth grey.

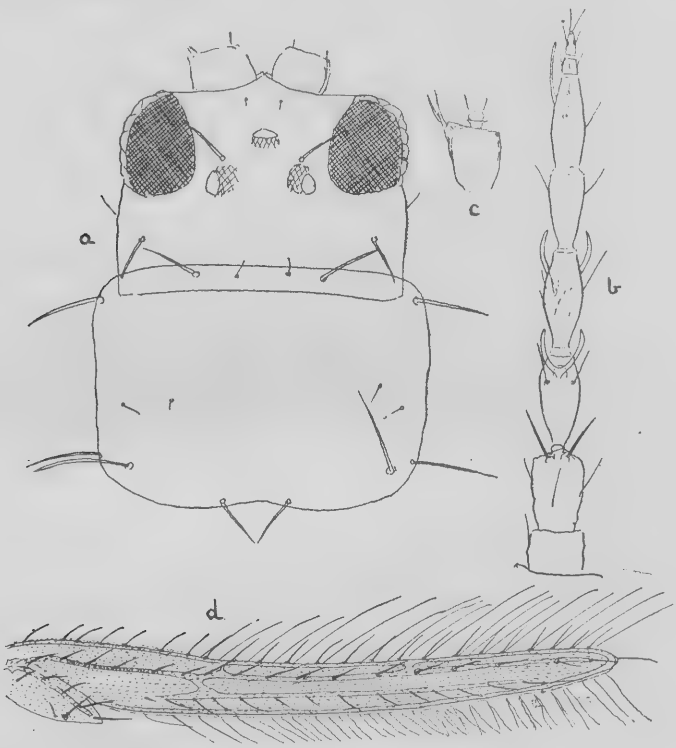


Fig. 2.—*Frankliniella melanommatus*, n.sp.
a, head and prothorax; *b*, antenna (from above); *c*, lateral view of second antennal segment; *d*, wing.

Prothorax wider than long, and slightly longer and wider than the head; its hind angles rounded. Two long spines at each hind angle, and one on each front angle, two slightly shorter on the anterior margin, and two shorter again on the hind margin. Pterothorax large, front angles rounded, two long spines in the middle between the wings. Legs with numerous short hairs, posterior tibiae with two stout spines at the apex. Wings reaching to

about the eighth abdominal segment, the marginal vein and two longitudinal veins distinct in the fore wing (Fig. 2*d*). The posterior vein arises at about one quarter of the wing's length from the base, and reaches nearly to the tip of the wing. It has in its length usually twelve or thirteen spines (varying from ten to fifteen in the specimens examined), and is connected at about the level of the second spine to the front vein by a branch from the latter. There are seventeen to twenty spines on the fore vein, and twenty-two to twenty-six on the costa. There is also a distinct vein with five spines on it on the basal lobe. Hind wings clear, vein indistinct, but distinguishable almost to the apex, the minute hairs with which the whole wing is covered being darker along its length.

Abdomen normal; a single distinct posterior-lateral spine on the segments 1-7, two on segment 8, eight long spines on the ninth segment, and four long and two shorter on the tenth segment.

Male smaller than the female (about 0.80 mm.). Abdomen rounded at the tip, with a pair of long spines on the posterior-lateral margin of the ninth segment, each on a slight tubercle, and a similar pair on the tenth segment. The testicles are yellow. The number of spines on the hind vein of the fore wing is less variable than in the female, being almost always twelve (once eleven and once thirteen out of about sixteen counts).

Described from four females and about a dozen males collected on Cassava (*Mandiocca utilissima*) in the Agricultural Experimental Station, Kingstown, St. Vincent, West Indies, by Mr. F. Birkinshaw, in October, 1912.

Type in the Hope Department, Oxford University Museums.

This species comes very near to *Frankliniella cephalica* (Crawford),[1] which it resembles in the shape of the head, the structure of the second antennal joint, and the colour. It can be separated from that species, however, by the following points, which, I think, justify it ranking as a distinct species.

A. Eyes yellow, 8th antennal joint shorter than the 7th, a single trichome on the 3rd joint, 17 spines on the hind vein, front ocellus directed straight forward.
. . . *F. cephalica* (Crawford). Mexico.

AA. Eyes dark, 8th antennal joint longer than the 7th, forked trichome on the 3rd antennal joint, about 12 (10-15) spines on the hind vein, front ocellus only slightly directed forward.
. . . *F. melanommatus*, n. sp. W. Indies.

[1] Both of these species are readily separated from the recently described *Stylosa*, Hood, by the colour.

RECORDS AND DESCRIPTIONS OF BRITISH THYSANOPTERA.

By

C. B. WILLIAMS, B.A., F.E.S.,

The John Innes Horticultural Institution, Merton, Surrey.

WITH 3 FIGURES.

DURING the past two years I have been able to give a certain amount of time to the collection and study of the Thysanoptera, and herein I record some observations on the more interesting species, descriptions of *Rhipidothrips brunneus, Euthrips badius, Bagnallia variabilis, Bagnallia asemus,* spp. nov., and further record *Cryptothrips major,* Bagnall, as new to the British Fauna.

I have found the method of collecting flowers in paper bags, recommended by Uzel, to be of great value, as it is possible to get material by post from various parts of the country from correspondents who know nothing of entomology. Thus I have already in this way received specimens of the Pea thrips, *Frankliniella robusta* (Uzel) from about twenty-four counties in England, Wales and Ireland.

I have deposited types of all the new species described below in the Hope Department of the Oxford University Museums.

Order THYSANOPTERA.

Sub-order TEREBRANTIA.

Family **Aeolothripidae.**

Aeolothrips albocinctus, Hal.

One apterous female at Wicken Fen, Cambridge, on July 27th, 1913.

Rhipidothrips brunneus, n. sp.

Female (Forma Brachyptera).

Measurements.—Head, length, 0.190 mm., width, 0.190 mm.; prothorax, length, 0.160 mm., width, 0.210 mm.; pterothorax, length, 0.25 mm., width, 0.24 mm.; abdomen, width, 0.41 mm.; wing, length about 0.16 mm.

Antennae.—

Segment	-	1	2	3	4	5	6	7	8	9
Length (μ)	-	20	36	68	60	56	41	36	16	12
Width (μ)	-	40	30	24	24	26	24	20	14	8

Total body length about 1.62 mm.; antennae, 0.36 mm.

[JOURN. ECON. BIOL., December, 1913, vol. viii, No. 4.]

Colour, dark brown, with the third and fourth antennal segments, the tarsi, and the apical parts of the tibiae lighter.

Head as long as wide. Cheeks slightly arched, bearing four or five short, stout, forwardly directed spines in their anterior half just behind the eyes. Two small setae in front of the anterior ocellus, and two on each side of it near the margin of the eye; a longer seta between the anterior and each posterior ocellus. Several smaller hairs scattered over the posterior dorsal part of the head. Eyes dark, not prominent. Ocelli small, placed at the corners of a nearly equilateral triangle; the two posterior close to the margins of the eyes, the anterior one directed slightly forward. Crescents not apparent. The mouth-cone reaching two-thirds across the prosternum. The maxillary palpi three-jointed, with the last segment very short. The labial palpi cannot be made out in the specimen, but doubtless conform with the generic type in being four-jointed. The antennae are almost twice as long as the head; the first segment short and stout, the second barrel-shaped, the third long and with a distinct pedicel, the fourth slightly shorter than the third, the fifth, sixth and seventh are rather broadly articulated, while the seventh, eighth and ninth form a more or less complete whole. The seventh segment is longer than the eighth and ninth together. A single sense cone near the distal end of the fifth segment ventrally, and another similarly situated on the sixth segment. Colour: first and second segments dark brown, third and fourth much lighter, fifth to ninth darker, but not so dark as the first two. The anterior margin of the first segment bears dorsally and ventrally a small projection.

Prothorax shorter but wider than the head, its hind angles square. A very short, stout, curved spine at each front angle. A long spine just anterior to each hind angle and a small curved one at the hind angle. Two pairs of comparatively stout spines on the hind margin, each pair being close together. Pterothorax broader than the prothorax, but not very stout. Legs dark, with the outer half of the tibiae and all the tarsi a little lighter. Wings reduced to small white pads, not reaching beyond the hind margin of the pterothorax.

Abdomen stout, no long spines except on the last two segments, where they are pale brown in colour, but not so light as those of *R. gratiosa*, Uzel.

Described from a single brachypterous female beaten from grass on May 25th, 1913, on the coast at Bognor, Sussex, England.

Type placed in the Hope Department, Oxford University Museum.

The three known species of the genus *Rhipidothrips* can be easily separated as follows :—

I. Without spines at the hind angles of the prothorax.
. . . . *R. niveipennis*, Reuter. Finland.

II. With a long spine at (or near) the hind angle of the prothorax.

(*a*) Second antennal segment light. Prothorax light with dark central markings, all femora light at the apex and base. Six or eight more or less regularly placed, light coloured spines along the hind margin of the prothorax.
. . . . *R. gratiosa*, Uzel. Bohemia, England.

(*b*) Second antennal segment dark. Prothorax and femora uniformly brown as the rest of the body. Two pairs of spines on the hind margin of the prothorax.
. . . . *R. brunneus*, n. sp. England.

R. brunneus may be further distinguished from *R. niveipennis* by the colour of the tibiae, by the fifth antennal segment being dark (light in *niveipennis*), also the seventh segment of the antenna in *brunneus* is longer than the eighth and ninth together, whereas Reuter[1] figures the seventh, eighth and ninth as more or less equal in length in *niveipennis*. It also differs from *R. gratiosa* in the arrangement of the small setae round the ocelli, and in having fewer small setae on the posterior dorsal surface of the head. My British specimens of *R. gratiosa* have a sharply marked off area at the back of the head, where the striations of the surface is much more distinct; this area is also present in *brunneus*, but is not so well marked. Further, my specimens of *R. gratiosa* have a row of short, stout spines behind each eye, not mentioned in Uzel's description of the species, resembling those described above in *brunneus*, but differing slightly in number and arrangement.

Melanothrips fuscus (Sulz.).

Not uncommon in various flowers. A plant of *Sinapis arvensis* on the University Farm, Cambridge, was swarming with this species on the 25th May, 1911, nearly all the specimens being males. Later in the year only females were taken.

Family **Thripidae.**

Chirothrips manicatus, Hal.

The only forms of this species that I have taken are the macropterous female and the apterous male, both of which are not uncom-

[1] Acta Soc. Fauna. Flora Fennica, 1899, xvii., No. 2, p. 30.

mon in grasses and sedges. For the same day (12/9/11) I have the two following records, which show an interesting contrast :—"Wimbledon, Surrey, on *Molinia,* males abundant, including some var. *adusta,* Uzel, one female"; "Horning, Norfolk, on *Typha* and *Phragmites,* 42 females, no males (per G. Storey)." I have found the winged females hibernating in sedge stacks at Wicken Fen.

Limothrips cerealum, Hal.

Common in both sexes and widely distributed. Females hibernating under bark and in sedge stacks, September to April.

Limothrips denticornis, Hal.

I have not found this so abundant as the preceding, but both sexes were common on Barley at Wicken in July. Also females hibernating in the sedge stacks during the winter.

Sericothrips staphylinus, Hal.

Brachypterous males and females not uncommon in *Ulex europaeus* in the New Forest, September, 1911. Macropterous females among grass near Oxford, July, 1913.

Frankliniella tenuicornis (Uzel).

I have taken a single female of this species on oats at Wicken Fen, Cambridgeshire, on July 27th, 1913.

Frankliniella robusta (Uzel).

This species, described by Uzel in 1895 (Monog. dei Thysanoptera, p. 104) as *Physopus robusta* is the same as that described by Westwood as *Thrips pisivora* in 1880 (Gardeners' Chronicle, 2nd series, vol. xiv, p. 206), but as the latter described only the larva, which he found damaging peas, Uzel's name must take precedence. Uzel's genus *Physopus* having since been split up the name now stands as above.

This species is often very injurious to peas and beans in this country. I have succeeded in following through its complete life-history, and although intending to write a more complete account at some future date, I give here the following short summary, it seeming unnecessary to delay the publication of facts of economic importance while several small points of purely scientific interest are settled.

Adults are to be found from the middle of May to the end of July. The males only occur during the first part of that time. The eggs are laid, as discovered by Warburton (Journ. Roy. Agric. Soc.,

England, 1898, vol. lxix, p. 321) chiefly in the stamen sheath of peas (*Pisum satua*) or beans (*Vicia faba*), and hatch after about eight days. The larva, orange-yellow with a black tail, is full-fed in about sixteen to twenty days, when it descends into the soil. There it remains throughout the rest of the summer, autumn and winter till the following May, when it passes through its two pupal stages and emerges as the perfect insect at the end of May or during June.

Physothrips pyri (Daniel).

I have taken this species, so injurious in America, on apple at Histon, near Cambridge, in 1911, and have had specimens sent to me from Cambridge this year. I also received larvae which I believe to belong to this species from Cirencester. There is no doubt that it has been with us for many years, and must occur in many other localities, either not common enough to do any damage, or else having the damage it does attributed to some other pest.

Oxythrips ajugae, Uzel.

This species occurs in abundance in the pines, especially those bearing male cones, at Oxshott, Surrey, in the spring. I have also taken hibernating adults of both sexes from pine stumps in the winter by means of the Berlese Funnel. I do not yet know what happens to it during the rest of the year.

Euthrips (Anaphothrips) obscurus (Mull.).

A single macropterous female on *Spartina*, Hamble Creek, Hampshire on September 5th, 1911.

Euthrips orchidaceus (Bagnall).

I found this species not uncommon in the Liverpool Botanic Gardens on various orchids, *e.g.*, *Cypripedium*, *Epidendron*, *Miltonia*, *Oncidium*, *Mormodes*, *Odontoglossom*. The male, of which I took four specimens, has only been mentioned by Mr. Bagnall,[1] and has not yet been described.

Male smaller than the female (about 1 mm.), general colour pattern similar, but without the brown dorsal patches on the second to seventh abdominal segments. The first two antennal joints are light-coloured. The orange-coloured testes distinctly visible. On the dorsal side of the ninth abdominal segment are two pairs of short, stout spines, one pair on the extreme posterior margin, and the other just anterior to these, and very slightly longer.

[1] Ent. Mon. Mag., 1909, vol. xx, p. 34.

Euthrips badius, n. sp.

(Fig. 1).

Female. Measurements.—Head, length, 0.128 mm., width, 0.158 mm.; prothorax, length, 0.128 mm., width, 0.208 mm.; pterothorax, length, 0.280 mm., width, 0.274 mm.; abdomen, width, 0.307 mm.; wings, length (from tip of wing to tip of basal lobe), 0.726 mm., width (about half-way along), 0.065 mm.

Antennae.—

Segment	1	2	3	4	5	6	7	8
Length (μ)	8	31	39	37	37	35+10	7	10
Width (μ)	28	28	19	18	18	18	6	4

Total body length, about 1.25 mm.; antennae, 0.228 mm.

Colour, dark brown. Tarsi and ends of tibiae slightly lighter. Head (Fig. 1*a*.) wider than long, rounded in front. Sides slightly diverging posteriorly, cheeks very slightly arched, back of head faintly striated. Only short hairs on the upper surface; four in a transverse row in front of the ocelli; one in front of, and one behind each posterior ocellus, and two behind each eye. Eyes black, not protruding. Ocelli distinct, forming an almost equilateral triangle. Crescents red brown, distinct, broadest on posterior ocelli. Mouth cone fairly large, reaching three-quarters across the prosternum. Maxillary palpi three-jointed, third joint longest, middle shortest (Fig 1*b*.). Labial palpi two-jointed, basal joint short and stout, with three sensory hairs at the tip of the second joint (Fig. 1*c*.).

Antennae apparently nine-segmented, owing to the presence of a slightly oblique cross division in the sixth segment; not quite twice as long as the head. Colour, dark brown, second, third and base of fourth segment slightly lighter. First segment very short and thick, second large and almost spherical, third distinctly longer than second, fourth and fifth only slightly shorter than the third. Cross division in the sixth segment about one-fifth of its length from the anterior end. Forked trichomes on the dorsal side of the third segment, and on the ventral side of the fourth segment (Fig. 1*d*.).

Prothorax as long as the head, and distinctly wider, hind angles rounded. Four or five small spines along its hind edge on each side. No long spines on the hind angle. Mesothorax largest, with front angles rounded. Metathorax gradually constricted behind. Legs dark, with the tarsi and ends of the tibiae slightly lighter. Fore and mid tibiae without conspicuous spines, hind tibiae with two distinct spines at the end, and a row of six or seven along the inner margin. Six spines on the hind tarsus, two in continuation of

the row on the tibia, two dorsally near the base of the tarsus, and two dorsally at the tip projecting over the second joint.

Wings fully developed, reaching to the posterior margin of the eighth abdominal segment. Fore wings (Fig. 1*e*.) strongly clouded with a small round clearer spot between the two veins near the base, just beyond the joint of the lobe, about one-fifth of the width of the

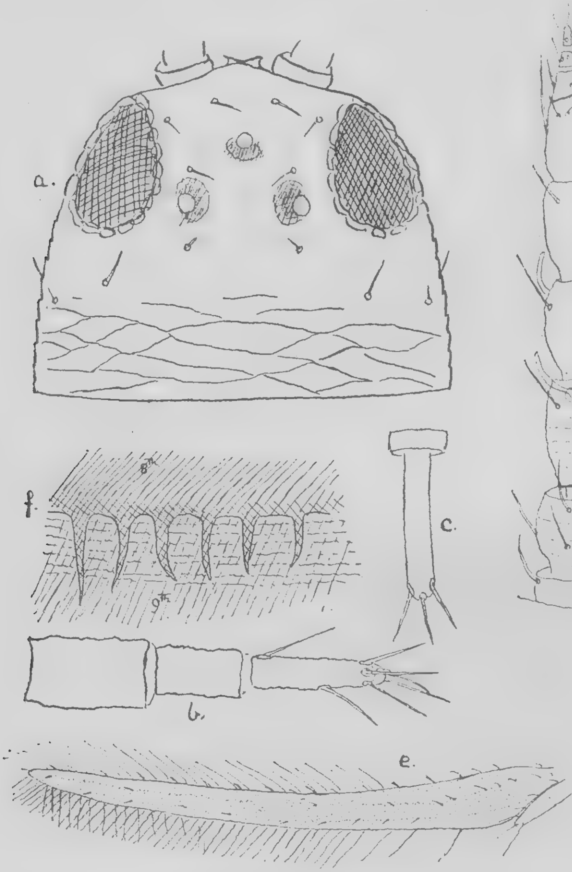


Fig. 1.—*Euthrips badius*, n.sp.
a, head; *b*, maxillary palp; *c*, labial palp; *d*, antenna; *e*, wing;
f, portion of "comb" on hind margin of 8 abdominal tergite.

wing at that point in diameter. Veins indistinct, seven to ten spines on the hind vein, the distal ones further separated than the proximal. On the fore vein seven to nine spines at the base, then a short space, then either one or two, then another space, then two more. All the spines on the wing are short. Hind wings almost transparent,

slightly clouded at the very base, the single vein distinct almost to the tip of the wing.

Abdomen stout, rapidly contracted in the eight and ninth segments. The tenth segment half again as long as wide at the base. A comb-like arrangement of short spines of the hind margin of the eight tergite, with transverse striae beneath on the ninth segment (Fig. 1*f*.). Spines on the ninth segment slightly longer than the tenth segment, spines on the tenth segment shorter.

Male about one-fifth smaller than the female, and slightly paler in colour, more particularly the wings. Two pairs of short, stout spines on the dorsal posterior region of the ninth abdominal segment, the anterior pair being slightly stouter and closer together. There are small, thinly chitinised areas on the second to ninth abdominal sternites shaped as follows:—On the second sternite oval with the posterior margin a little indented; on the third kidney-shaped; on the fourth the indentation of the hind margin almost divides the area into two; on the fifth a plain oval; on the sixth sternite a small circular area. Otherwise the male is similar to the female.

Described from specimens obtained at Wicken Fen, Cambridgeshire, England, as follows:—Three females found hibernating in a stack of cut sedge (*Carex*), on March 11th, 1912, another female taken in a similar situation on the 20th April, 1913, and about sixteen females and two males beaten from grass and sedge on July 27th, 1913. It is noticeable that all the specimens taken on the latter date are a little smaller and paler than those taken in the winter, suggesting a possibility of slight seasonal variation.

Types of both sexes placed in the Hope Department, Oxford University Museums.

The species *obscurus*, (Mull.), and *secticornis* (Trybom), are the only other members of the genus *Euthrips* which have the sixth antennal joint divided, and from these the above species may be separated as follows:—

I. Second antennal joint sub-spherical, much broader and shorter than the succeeding three joints.

(*a*) Colour light; first antennal joint clear; head about as wide as long, slightly square in front with the eyes a little protruding; two or three spines on the outer half of the fore-vein.

. . . . *obscurus* (Mull.). (*striatus*, Osborne). Europe. N. America.

(*b*) Colour dark brown; antennae, including the first segment, dark; head wider than long, rounded in front; eyes not protruding; three or four spines on the outer half of the fore-vein.

. . . . *badius*, n. sp. England.

II. Second, third, fourth and fifth antennal joints all of the same length and width.

. . . . *secticornis* (Trybom). N. America.

Aptinothrips rufus, Hal.

This abundant grass-inhabiting species is interesting both from the scarcity of its males and from the fact that two forms are known, differing in the number of the joints in the antennae. The commonest form in this country has the antennae six-jointed (v. *connaticornis*) while a scarcer and more local variety has the antennae with eight joints, the last three being equivalent to the sixth joint in var. *connaticornis*. The two forms do not usually occur together, and out of very many records for this species I have only twice taken both forms together at one place. During this last September (1913) I have taken about twenty males of this species among many hundreds of females. The males do not seem to occur at any other time of the year.

Bagnallia asemus,[1] n. sp.

(Fig. 2).

Female (*Forma Brachyptera*).

Measurements.—Head, length, 0.11 mm., width, 0.11 mm.; prothorax, length, 0.11 mm., width, 0.153 mm.; pterothorax, length, 0.226 mm., width, 0.2 mm.; abdomen, width, 0.253 mm.; wing, length (from tip of wing to tip of basal lobe), 0.125 mm.

Antennae.—

Segment	1	2	3	4	5	6	7
Length (μ)	25	33	37.5	36	36	44	14
Width (μ)	25	22	19	19	16.5	19	8 5

Total body length about 1.3 mm.; antennae, 0.233 mm.

Colour, greyish-brown, with a tinge of yellow. Tarsi and ends of tibiae slightly lighter.

Head about as wide as long, sides slightly diverging behind, back of the head faintly striated. Two hairs in front of the anterior ocellus, one near the margin of each compound eye,

[1] α—$\sigma\eta\mu\alpha$ = without character.

one in front of, and one behind each posterior ocellus, and four or five shorter ones behind each eye. Eyes black. Ocelli forming an almost equilateral triangle, reddish-brown crescents present, but not very distinct. Mouth-cone bluntly pointed, reaching about two-thirds across the prosternum. Maxillary palpi three-jointed (Fig. 2*a*). Labial palpi two-jointed, the basal segment very short and broad (Fig. 2*b*). Antennae seven-segmented, a little more than twice as long as the head. Colour brown, with the apical part of the

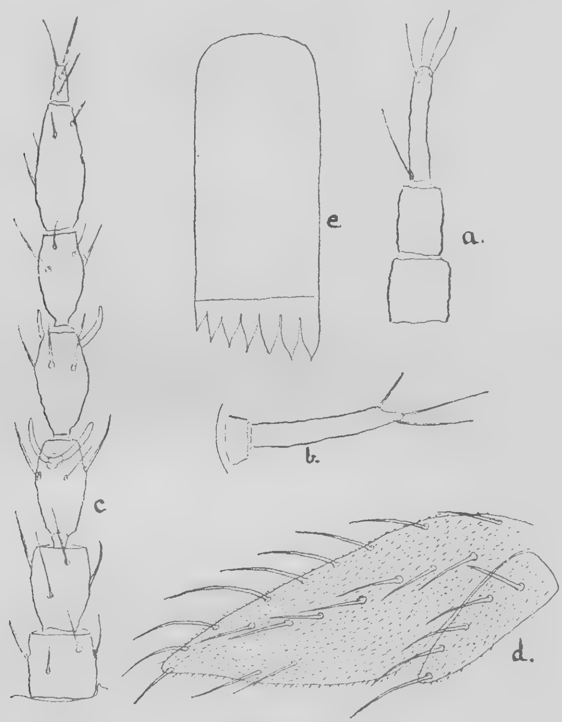


Fig. 2.—*Bagnallia asemus*, n.sp.

a, maxillary palp; *b*, labial palp; *c*, antenna (from above); *d*, wing; *e*, ventral pleurite of fifth abdominal segment.

second joint, and the whole of the third joint, slightly lighter. First segment short and cylindrical; second slightly constricted at the base, truncate at the apex; third with a short distinct stem, fusiform; fourth fusiform; fifth constricted at the base, apex sub-truncate; sixth the longest; seventh about twice as broad at the base as at the tip. A forked trichome on the dorsal side of the third segment, and one on the ventral side of the fourth (Fig. 2*c*).

Prothorax as long as the head, slightly widening behind; posterior angles rounded, each with two long spines; four or five smaller ones along the hind margin on each side. Pterothorax a little wider than the prothorax, its front angles rounded. Legs of the same colour as the body, with the tarsi and the distal portion of the tibiae, more particularly on the fore-leg, slightly lighter; fore-tarsus unarmed, fore and mid tibiae with only weak spines, hind tibiae with two spines at the end internally, and a row of six or seven along the inner margin. A few spines on the first joint of the hind tarsus. Wings rudimentary, barely reaching beyond the pterothorax, fore pair slightly tinged with brown, with seven spines on the rudiment of the fore-vein, two on the hind vein, and nine along the costal margin (Fig. 2*d*). Hind wings almost transparent, slightly shorter than the fore-wings.

Abdomen normal, hairs short except on the ninth and tenth segments. The tenth segment about as long as broad at the base. The rudiments of the eleventh segment distinctly visible as three small chitinised plates, one dorsally, and two smaller ventrally. The ventral pleurites of the second to seventh segments are strongly pectinated behind (Fig. 2*e*).

Egg.—There are two apparently fully-developed eggs visible in the abdomen of one of the specimens, lying longitudinally and slightly overlapping, the anterior one occupying the fourth and fifth segments, the other part of the fifth, the sixth, and part of the seventh. They are kidney-shaped, and about 0.25 mm. long by 0.13 mm. broad.

Type in the Hope Department, Oxford University Museums.

Described from three specimens; one taken in a flower of buttercup (*Ranunculus*, sp.) on the University Farm, Cambridge, England on the 8th of May, 1911, and two others taken at the same spot in flowers of dandelion (*Taraxacum officiniale*) on the 22nd of April, 1913.

This species is easily separated from *calcarata*, Uzel, by the absence of the fore tarsal tooth; from *capito*, Karny, *klapaleki*, Uzel, *palustris*, Reut., *longicollis*, Uzel, and *viminalis*, Uzel, by the colour, or the relative length, of the segments of the antennae; from the two latter it is also distinguished by its larger size. It differs from *discolor*, Hal., in its colour, from *angusticeps*, Uzel, in the size and in the colour of the fore tibiae, from *dilatata*, Uzel, in the normal width of the abdomen and the colour of the fore tibiae, and from *agnessae*, Bagnall, by the slightly smaller size and relatively longer antennae.

Bagnallia variabilis, n. sp.

Female. Measurements.—Head, length, 0.12 mm., width, 0.125 mm.; prothorax, length, 0.13 mm., width, 0.16 mm.; pterothorax, length, 0.27 mm., width, 0.225 mm.; abdomen, width, 0.27 mm.; wing, length (from tip of basal lobe), 0.65 mm., width (about half-way along), 0.044 mm.

Antennae.—

Segment	-	1	2	3	4	5	6	7
Length (μ)	-	22	39	43	42	34	45	12
Width (μ)	-	26	24	20	21	18	21	8

Total body length, 1.2 mm.; antennae, 0.26 mm.

Colour, dark grey-brown, the pterothorax slightly more yellowish. The third segment of the antennae paler and also the tarsi and the end of the tibiae. Wings pale brown.

Head very nearly as long as wide, not constricted behind. Cheeks slightly arched. Two small setae near the margin of each eye just anterior to a line through the front ocellus. One small seta in front of each posterior ocellus, and five small setae in a line from behind each posterior ocellus to behind the eye, the last being a little separated from the other four. A few other very small setae scattered over the hind part of the head, which is distinctly striated. Eyes rather large, not projecting, black; the space between them equal to the width of the eye. Ocelli distinct, close together, forming an obtuse triangle. Crescents distinct, red brown, largest on the posterior ocelli. Mouth cone rather long, reaching nearly across the prosternum. Maxillary palpi three segmented, the middle segment being the shortest and the distal one the longest. Three sense hairs on the tip of the last segment and one at its base. Labial palpi two segmented, the basal segment very short, four sense hairs at the tip of the distal segment. Antennae more than twice the length of the head; the first segment short and stout, the second longer, the third with a distinct pedicel, the fourth as long as the third, the sixth the longest, slightly longer than the fourth, the seventh short. Colour: the first and second dark brown, the former being a little more opaque than the latter; the third much paler, sometimes slightly darker at the tip; the fourth to seventh as dark as the second. A forked trichome on the distal side of the third segment, and one on the ventral side of the fourth.

Prothorax longer and wider than the head; two very short curved spines at each front angle, and two long spines at each hind angle; also about six smaller spines along the hind margin of the pronotum. A number of small setae scattered over the pronotum.

Pterothorax stout, much wider than the prothorax, front and hind angles rounded. Legs brown, the tarsi and the ends of the tibiae paler, two stout spines on the inner side of the apex of the hind tibiae. Wings fully developed, fore wings light brown, hind wings almost clear. The number of spines on the veins of the wings is very variable; 24—28 on the costa, 15—19 on the hind vein, and 8—13 on the outer half of the fore vein. Sometimes on the fore vein the space between the outer and the basal spines is quite small, the two series appearing almost continuous.

Abdomen normal, the ventral pleurites are pectinate posteriorly. The long setae on the ninth and tenth segments are about as long as the tenth segment.

Described from five females beaten from *Pinus* and three females in flowers of *Genista anglica* close by, on May 11th, 1913, at Matley Bog, New Forest, Hampshire, England.

Type placed in the Hope Department, Oxford University Museum.

The two genera *Thrips* and *Bagnallia* approach very close to one another, and it is doubtful if they are really distinct. For the present, however, we place this species in the latter genus on account of its relatively long head. It is easily distinguished from the other members of this genus by the large and varying number of spines on the outer half of the fore vein.

Stenothrips graminum, Uzel.

Bagnall has already (Journ. Econ. Biol., vol. vii, p. 194) recorded this species from near Oxford and Tring. I have taken it in the former locality and also at Wicken, Cambridgeshire on oats.

Sub-Order TUBULIFERA.

Fam. **Phloeothripidae.**

Megathrips nobilis, Bagnall.

(Fig. 3).

A single dead male and three larvae of this species were beaten from a sedge stack at Wicken Fen, Cambridgeshire, in March, 1912. The larval form being as yet undescribed, I give the following short description.

Old larva.

Total body length, 2.8 mm.; head length, 0.4 mm.; antennae, length, 0.7 mm.

Colour, vermilion and brown; the head, prothorax, legs, and last three abdominal segments are more strongly chitinised, and also, to a slightly less degree, a row of small spots on each of the abdominal segments 1—7, and on the metathorax, and two rows on

the mesothorax. In all these parts the chitin is darker in colour, obscuring the red which lies underneath and which is visible at the sutures and on the rest of the body. There is, on the head, a dorsal longitudinal suture between the chitinised plates, starting from the posterior margin, widening gradually in front, and finally dividing into two branches, one of which runs to the base of each antennae just in front of the eye. In this broad suture just at the fork is a small round plate. There is also a slightly depressed and less chitinised strip from each lateral posterior edge of the head, reaching forwards and dorsally to about half way along the head (Fig. 3*a*.). The dorsal suture on the head is continued behind between the two dorsal prothoracic plates. The tenth abdominal segment is

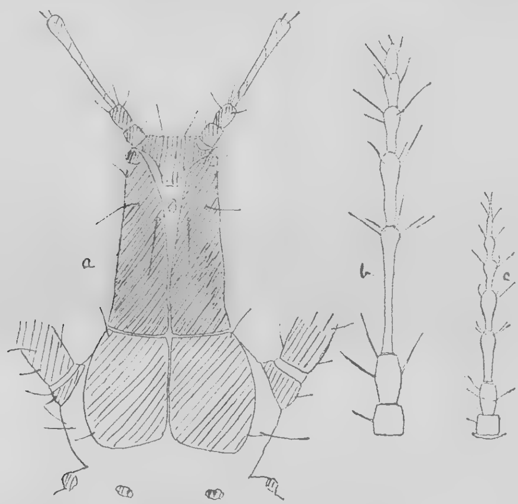


Fig. 3.—*Megathrips nobilis*, Bagnall. Larvae.
a, head and prothorax of old larva; *b*, antenna of ditto; *c*, antenna of younger larva.

thickly chitinised all round, the ninth is thickly chitinised above but slightly less so beneath. On the eighth segment there are two large dorso-lateral plates, which nearly meet above, and two smaller ventral plates. On the abdominal segments 1—7 there are eight small plates, two dorsal, two dorso-lateral, two lateral and two ventral, each bearing a hair. Tubus not quite twice as long as broad at the base.

The antennae are strongly chitinised. First joint dark, second dark, light at the tip, third light, dark at the tip, the fourth light at the base, the rest dark. (Fig. 3*b*.).

Younger larva.—Length, 1.8 mm.; head, length, 0.21 mm.; antennae (Fig. 3*c*.), length, 0.39 mm.

Red colour less bright, chitinisation much less strong, except on the last two abdominal segments and the antennae, which are already fairly dark, the latter, however, being more unicolourous than in the older larva.

Described from one large and two smaller larvae.

Cryptothrips dentipes (Reuter).

Both sexes common, hibernating in the sedge stacks at Wicken Fen, Cambridge.

Cryptothrips major, Bagnall.

This species was described from a single female, taken by Mr. Bagnall in Norway on December 16th, 1912.[1] I was fortunate enough to find it in some numbers in a stack of Pea sticks (mostly Hazel) stored for the winter at Merton, Surrey, taking altogether 9 females, 6 males, and 13 larvae. As the male and the larva are hitherto unknown, I give short descriptions.

Male smaller than the female (in the proportion 3 to 5). Front tarsi lighter than in the female, with a large claw on the first joint. Otherwise similar to the female.

The larvae are orange-red in colour, with the last two segments, the antennae (except for the first joint) and the tibiae dark brown, and the head and prothorax lighter brown. The femora are dark at the basal half and light in the apical half. The arrangement of the chitinised plates on the head and prothorax very similar to that shown above for *Megathrips nobilis*, Bagnall. Each tarsus bears two small claws.

Cephalothrips monilicornis (Reuter).

Mr. Bagnall has already recorded (Ent. Mon. Mag., 2nd series, 1912, vol. xxiii, p. 190) that I took two specimens of the winged form of this species at Matley Bog, in the New Forest. There was at that time only a single other winged specimen known (from Poland), but I have since found it not uncommon at Wicken Fen, Cambridgeshire, where out of 27 specimens beaten from a stack of sedge in the winter, 18 were winged.

Hoplothrips corticis, Serville.

(= *Acanthothrips nodicornis*, Reuter).

Several specimens were beaten from a bundle of faggots in Bagley Wood, near Oxford, on August 7th, 1912.

---

[1] Ent. Mon. Mag., 2nd series, 1911, vol. xxi, p. 60.

THE BRITISH SPECIES OF THE GENUS *TETRACANTHELLA* (COLLEMBOLA).

By RICHARD S. BAGNALL, F.L.S.

(With 9 Text-figures).

In 1891 Schött[1] described *Tetracanthella pilosa*, the type of a new genus, and figured it in 1893 in his *Zur systematik und Verbreitung Palaearctischer Collembola*. In 1900 Wahlgren[2] in a paper, *Collembola der Bären-Insel*, records as *T. pilosa* a somewhat similar insect, differing chiefly in the shorter, incomplete spring, to which Axelson[3] later gave the name of *T. wahlgreni*. At this time the genus was placed in either the Lipuridae (Aphoruridae) or the Poduridae, but research has shown its affinities with *Isotoma*, and the genus is now placed with *Anurophorus* in the Entomobryidae at the beginning of the Isotominae.

Dr. W. M. (Axelson) Linnaniemi describes the two species, *pilosa* and *wahlgreni* in his *Die Apterygoten Finlands*, II., and it should be remarked that though Schött in diagnosing the genus says, "Pili clavati in segmentis apicalibus stipati, in ceteris dispersi," and figures the insect with very pronounced clubbed hairs on the abdominal segments, the *pilosa* of Axelson-Linnaniemi possesses simple hairs.

For some time I have observed a *Tetracanthella* which occurs not uncommonly in *Sphagnum* on our northern moors and hills, and which on account of Schött's misleading figure I could not reconcile with *pilosa*. However on the appearance of the second part of Axelson Linnaniemi's splendid work on the Finnish Apterygota the species was readily identified with *pilosa* as diagnosed and figured by him, my examples agreeing perfectly in every detail. More recently, whilst collecting Thysanoptera in the neighbourhood of Oxford, I had the good fortune of beating out a second species of *Tetracanthella* from old sallow stems, which, even on the field, I concluded to be referable to the genus. This latter insect

[1] Entom. Tidskr., pp. 191-192.

[2] Bih. till K. Sv. Vet.—Akad. Handl., 26.

[3] Die Apterygoten Finlands, I, 1907,

differs considerably from the two hill forms, thus necessitating some slight modifications in our present conception of the genus. It is quite possible that some future worker may erect a new genus for its reception, but, remembering the extraordinary variety in the number of anal horns in *Tullbergia*, and the fact that at least one species of *Aphorura* possesses a spring, I hesitate to take this step.

Genus **Tetracanthella**, Schött.

Lubbockia, Haller, 1880; *Deuterolubbockia*, v. Dalla Torre, 1895.

On the field species of this genus, though somewhat reminding one of *Anurophorus*, are very distinct little creatures, glossy, bluish-grey with lighter markings, and slow in their movements. *T. pilosa* occurs in numbers in *Sphagnum*, wet moss, etc., on our northern moors and hills to a height of 2,500 feet or more, whilst *wahlgreni*, which is more of an alpine form than *pilosa*, will almost certainly occur on some of our higher mountains.

The following key will enable workers to readily separate the species :—

1. Spring present, small. Anal horns large, 4. Inner claw of foot present. Size 1.5-2.5 mm. 2

   Spring absent. Anal horns small, 2. Inner claw of foot absent. Size 1.3 mm. **T. oxoniensis,** n. sp.

2. Spring longer, with mucro (2 teeth); Dens and mucro together about 0.75 the length of manubrium. Inner claw not bristle-like, about 0.25 the length of the outer claw. . . . **T. pilosa** (Schött), Axels.

   Spring shorter, without mucro. Mucrodens not quite 0.50 the length of the manubrium. Inner claw produced to a bristle-like ending, about 0.50 the length of the outer claw. . . **T. wahlgreni,** Axels.

Tetracanthella pilosa (Schött), Axels.-Linnaniemi.

Figs. 1-4.

Syn. See Axels.-Linnaniemi, Die Apterygoten Finlands, II, p. 101.

Haller's *Lubbockia coerulea* (1880) is doubtfully referred to this species, whilst the *Tetracanthella alpina* (1901) of Carl is synonymous. By a *lapsus calami* I referred to this insect in the *Entomological Record* (xxv, p. 226) under the name of *Tetracanthella schötti,* Wahl., a lamentable confusion of names caused by a too complete trust in my memory.

The species is readily recognised by its completely developed spring, which is longer than in *wahlgreni,* and by the shape of the empodium or inner claw of foot.

British Distribution.

I first took the species in numbers in *Sphagnum* on Chapel Fell near St. John's Chapel in Weardale, Co. Durham, in June, 1910, and later took a single example with *Isotoma* sp. in a nest of *Formica rufa* near Corbridge-on-Tyne, Northumberland (vii-1910). In September of the same year the species was met with in fair numbers at

Figs. 1-4. *Tetracanthella pilosa*, Schött. 1, Lateral view of end of abdomen, *i.e.* segments IV and V (+VI), × c. 90. 2, Dorsal view of anal horns, × c. 150. 3, End of tibio-tarsus and claw, × c. 360. 4, Lateral view of furca or spring, × c. 210.

Figs. 5-6. *T. wahlgreni*, Axels. (after Axelson-Linnaniemi). 5, End of tibio-tarsus and claw, × c. 360. 6, Lateral view of spring, × c. 360.

Ravenscar, Yorkshire, where it occurred in *Hypnum* on the cliffs at 600 feet, and in *Sphagnum* on the moors at about 700 feet,[1] whilst in May of this year I found it plentifully on Cheviot peak (Northumberland) at from 1,500 to 2,500 feet.

The *Tetracanthella* sp. recorded by Mr. Evans from Scotland are almost certainly referable to this species.

Previously known from Sweden, Norway, Finland, and the Swiss Alps.

Tetracanthella wahlgreni, Axels.-Linnaniemi.

Figs. 5 and 6.

Syn. See Axels.-Linnaniemi, Die Apterygoten Finlands, II, p. 103.

This species is closely allied to *pilosa*, but may be readily separated by the short spring which is without true mucrones, and has the apical

[1] Some of these Yorkshire examples were submitted to Dr. Axelson-Linnaniemi and returned as *T. pilosa*, Schött.

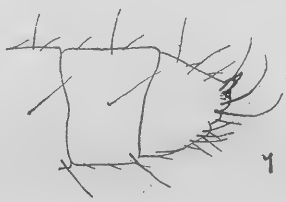
part (mucrodens) less than one-half the length of the manubrium, and by the bristle-like form of the inner claw.

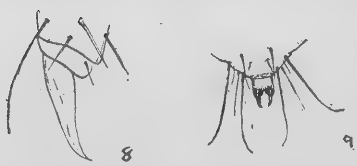
It is an alpine species, rarer than *pilosa,* and is known from Sweden, Norway, Spitzbergen, and Finland. It will almost certainly occur on our Scottish mountains.

Tetracanthella oxoniensis, n. sp.

Figs. 7-9.

Form generally, and colour as in *pilosa.* Antennal joints 3 and 4 practically subequal. Upper claw without inner lateral teeth, inner claw absent, tibio-tarsus with one outer tenant hair. Spring apparently absent. Anal horns on elongated papilla, 2, approximate. Abdominal segment IV dorsally longer than either III or V (+VI). Length 1.3 mm.





Figs. 7-9. *Tetracanthella oxoniensis,* n. sp. 7, Lateral view of end of abdomen, *i.e.* segments IV and V (+ VI), × c 90. 8, End of tibio-tarsus and claw, × c. 360. 9, Dorsal view of anal horns, × c. 150.

Type.—In Hope Collections, University Museum, Oxford.

Habitat.—In moderate numbers by beating dead sallow branches, near Kirtlington Park (Oxon.), September 21, 1913.

This species differs sharply from both *pilosa* and *wahlgreni* by the absence of the spring, the single pair of small, approximate, anal horns and by the absence of the inner claw of foot. The relative lengths of the antennal joints are 9: 15: 15: 23,—2 and 3 being subequal, whilst in *pilosa* 3 is distinctly smaller than 2.

The fourth abdominal segment in *pilosa* is shorter than V (+ VI), whilst in *oxoniensis* it is longer than either III or V (+VI).

[*Extracted from the* LINNEAN SOCIETY'S JOURNAL—ZOOLOGY, vol. xxxii. *October* 1913.]

On the Classification of the Order SYMPHYLA.

By RICHARD S. BAGNALL, F.L.S., F.E.S.
(Hope Dept. of Zoology, University Museum, Oxford.)

[Read 3rd April, 1913.]

As far back as 1882, in a note on the "Genera of the Scolopendrellidæ," * J. A. Ryder shows that there are two forms, stating that "the first has the body very slender, tapering anteriorly, with the eyes or stemmata placed on the upper surface of the narrow, elongate head; the second form has a broader, more robust body of nearly uniform width anteriorly and posteriorly, with the eyes or stemmata at the sides of the head and not visible from above, the head itself being nearly circular or sub-quadrate in outline from above.

"The first is the type to which we may assign the old designation of *Scolopendrella* originally proposed for it by Gervais †; the second, of which Newport's species (i. e., *immaculata*) becomes the type, may be distinguished generically from the first, as pointed out above, under the name of *Scutigerella*. The latter form is also distinguished from the first by the much greater development of the basal appendages of the legs.

Hansen ‡, in his excellent 'Monograph of the Order Symphyla' (established as an order by Ryder in 1880) says (p. 23): "The group consists of one single family with two genera," but in a footnote he adds, with some significance, "Some zoologist will perhaps soon establish these genera as families, and divide each of them into two or more genera."

Since Hansen's work was published in 1904 single species have been described by Imms, Silvestri, and Attems, whilst I have had the pleasure of examining very rich English material comprising no less than fourteen species and have just received numerous tubes of Oriental material.

Prior to the appearance of Hansen's monograph Silvestri § diagnosed a new genus, *Symphylella*, for the species of *Scolopendrella* in which the first pair of legs is absent, with *issabellæ*, Grassi as type. He also figured and described *Scolopendrella notacantha*, Gervais, and *S. pygmæa*, sp. n., species which agree in the possession of the first pair of legs, but which in my opinion are more strongly separated than *pygmæa* and *isabellæ*. This paper was not noticed by Hansen, and I am inclined to think that *Scol. subnuda*, Hansen, will prove to be synonymous with *S. pygmæa*, Silvestri.

In working out my material I have come to the conclusion that the genera *Scutigerella* and *Scolopendrella* as diagnosed by Hansen represent two

* Proc. U.S. Nat. Mus. v. (1882) p. 235.

† Ann. Sci. Nat. sér. 3, Zool. ii., 1844.

‡ "The Genera and Species of the Order Symphyla," Quart. Journ. Micr. Sci. xlvii., 1904.

§ In Berlese's 'Acari, Myriop. et Scorp. huc. in Italia rep.,' fasc. xcvi., 1902.

main groups, here treated as subfamilies but which might in future be readily given family rank, and that each contains at least three strongly characterized genera.

In the Scutigerellinæ (as I propose to name the first group) I was fortunate enough to collect two new species of the *immaculata*-group, which makes it safe to deal with *immaculata* as a type distinct from the *nivea*-group. In fact, although Hansen (*in litt.*) has always regarded *Scutigerella* as more difficult to deal with than *Scolopendrella*, this material has enabled me to tabulate the genera of the Scutigerellinæ in unmistakable characters.

In *Scutigerella*, s. str., the postero-median cavity of the last dorsal scutum is peculiar and is endorsed by the absence of the long outstanding antero-lateral or lateral scutular setæ. In this genus we find two species each possessing a distinctive character which does not reappear in succeeding groups,—*armata*, Hansen, having each fore-femur armed with a distinct tooth, and *biscutata*, Bagn., possessing a pair of plate-like prolongations hinged to the 13th dorsal scutum.

The second genus, *Neoscutigerella*, is erected for the English species *S. Hanseni*, Bagn., and in the character of its scutular setæ stands alone. The absence of the postero-median cavity of the last abdominal setæ precludes its reception in the genus *Scutigerella*, but here, too, the possession of longer, outstanding, and presumably sensory setæ is not shown. A second species of this genus (from Ceylon) is in my possession.

In the third and last genus, *Hanseniella*, the long outstanding setæ of the scuta appear for the first time, and this feature is continued throughout the genus and throughout the genera of the second subfamily, Scolopendrellinæ. In the Subgenus *Scolopendrelloides* (which may ultimately be split off from *Hanseniella*, s. str.), as exemplified by two species, we find three common characteristics of which two are noteworthy. Firstly the somewhat deep postero-median depressions of the last scutum suggests the curious cavity in *Scutigerella*, whilst the shorter exopods of the posterior legs lead one naturally to the Scolopendrellinæ.

Scolopendrella, s. str., in the well-developed legs of the first pair present a connecting link also, and this pair in the next genus, *Scolopendrellopsis*, is there also but smaller, and in *Symphylella* is obsolete. Whilst I have accepted Silvestri's genus *Symphylella*, I should here point out that as yet I have not succeeded in perceiving any valuable character other than the absence of its first pair of legs to warrant its separation from *Scolopendrellopsis* (but I have only examined the one species *subnuda*, Hansen), whilst from my table it will be seen that these genera cannot possibly be included in the genus *Scolopendrella*, being separated by the strongest morphological characters.

I name the genus *Hanseniella* in honour of one of our foremost zoologists, Dr. H. J. Hansen, of Copenhagen, whose friendship and help I am proud to acknowledge.

Family SCOLOPENDRELLIDÆ.

Species usually larger and more robust, with the first pair of legs always well developed and more than half the length of the following pair; the exopods well developed and conspicuous.

Posterior margins of all the dorsal scuta but the last slightly rounded or emarginate, with angles generally broadly rounded, rarely angular (but when angular each lobe is several times broader than long).

Dorsal surface of the hind pair of legs usually furnished with numerous setæ. Cerci simple, that is, without striped terminal area or transverse lines at apex.............................. Subfamily SCUTIGERELLINÆ, mihi.

2. Species smaller and more slender, with the legs of the first pair rarely more than one-half the length of those of the following pair (*S. notacantha* is the only exception), and more usually vestigial; none of the exopods well developed.

Posterior margins of all the dorsal scuta but the last one produced into a pair of triangular plates.

Dorsal surface of the hind pair of legs furnished with very few setæ. Cerci usually with a striped terminal area, and often, in addition, with raised transverse lines on the most distal part outside the area.

Subfamily SCOLOPENDRELLINÆ, mihi.

Subfamily SCUTIGERELLINÆ, mihi.

1. Last dorsal scutum with a very deep and somewhat large cavity overlapped anteriorly and situated in the middle of the posterior margin. No long outstanding setæ on lateral margins of scuta ...... Genus SCUTIGERELLA, Ryder.

Last dorsal scutum without such median cavity.......................... 2.

2. All setæ on scuta, excepting an antero-marginal pair on the first scutum, short, blunt, and fusiform...................... Genus NEOSCUTIGERELLA, nov.

All setæ normal. The second scutum (and certain others) furnished with at least one pair of longer, forwardly or laterally directed, latero-marginal setæ .... Genus HANSENIELLA, nov.

a. The last scutum slightly depressed posteriorly along the middle. The exopods of posterior legs well developed. The setæ on the inner side of the proximal antennal joints directed obliquely forwards and, at most, about one and one-half times as long as the setæ on the outer side.............................. Subgenus HANSENIELLA, s. str.

b. The last scutum with a deep postero-median depression. The exopods of posterior legs short, at most much shorter than the depth of tarsus. Some setæ on the inner side of the proximal antennal joints nearly vertical to the longitudinal axis of the antennæ and unusually long, the longest at least two and one-half times as long as the setæ on the outer side .... Subgenus SCOLOPENDRELLOIDES, nov.

Subfamily SCOLOPENDRELLINÆ, mihi.

1. First pair of legs well-developed, of normal shape and more than two-thirds the length of the following pair. Hind margin of each scutum with a distinct longitudinally striate belt between the pair of triangular processes. Cerci without the raised transverse lines at the most distal part. Central cephalic rod interrupted before the middle and there branching shortly to either side .... Genus SCOLOPENDRELLA, Gervais.

   First pair of legs reduced in size or (more usually) obsolete. Hind margins of scuta without striate belts. Cerci with raised transverse lines at the most distal part opposite to the terminal area. Central cephalic rod interrupted before the middle, but not branched laterally .... 2.

2. First pair of legs present, not more than one-half the length of the following pair .... Genus SCOLOPENDRELLOPSIS, nov.

   First pair of legs obsolete, represented by a pair of rudimentary wart-like protuberances, without claws even.................. Genus SYMPHYLELLA, Silv.

Species of the Order SYMPHYLA.

Subfamily SCUTIGERELLINÆ, Bagnall.

Genus SCUTIGERELLA, Ryder.

Species IMMACULATA (Newp.), *armata*, Hansen, *spinipes*, Bagn., and *biscutata*, Bagnall.

Genus NEOSCUTIGERELLA, Bagnall.

Species HANSENI (Bagn).

Genus HANSENIELLA, Bagnall.

Subgenus HANSENIELLA, s. str.

Species *unguiculata* (Hansen)*, *subunguiculata* (Imms.)†, *caldaria* (Hansen), *orientalis* (Hansen), *plebeia* (Hansen), *ruwenzorii* (Silvestri) ‡, NIVEA (Scop.), *chilensis* (Hansen), *capensis* (Hansen), and *angulosa* (Hansen).

Subgenus SCOLOPENDRELLOIDES, Bagnall.

Species CRASSICORNIS (Hansen), and *pauperata* (Hansen).

* Gravely names a subspecies *indica*, of which I shall have something to say later.

† Journ. Linn. Soc. Lond., Zool. xxx., 1909.

‡ Torino Boll. Mus. Zool. ed. Anat. vol. xxii., 1907. I have not yet seen the description.

Subfamily SCOLOPENDRELLINÆ, Bagnall.

Genus SCOLOPENDRELLA, Gervais.

Species NOTACANTHA, Gervais.

Genus SCOLOPENDRELLOPSIS, Bagnall.

Species MICROCOLPA (Muhr), *pygmæa* (Silv.), *subnuda* (Hansen) *, and *silvestrii* (Hansen).

Genus SYMPHYLELLA, Silvestri.

Species ISABELLÆ (Grassi), *dunelmensis* (Bagn.), *jacksoni* (Bagn.), *texana* (Hansen), *vulgaris* (Hansen), *horrida* (Bagn.), *neotropica* (Hansen), *simplex* (Hansen), *delicatula* (Bagn.), *minutissima* (Bagn.), *pusilla* (Hansen), *brevipes* (Hansen), and *antennata* (Hansen).

* Perhaps synonymous with *pygmæa*.

[NOTE.—I have not seen Graf Attems' description of his *Scutigerella indecisa* from South-West Australia, and have therefore been unable to include it in the above list.—R. S. B., 23rd July, 1913.]